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Report and preliminary results of R/V POSEIDON cruise POS448

CAPRICCIO

**Calabrian and Adriatic Past River Input and Carbon ConversIOn
In the Eastern Mediterranean**

Messina – Messina, 6 – 23 March 2013

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R/V POSEIDON

Cruise Report P448

CAPRICCIO

Calabrian and Adriatic Past River Input and Carbon ConversIOn In the Eastern Mediterranean

Messina - Messina 6 – 23 March 2013

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1. Participants

Name	Discipline	Institution	Nationality
Zonneveld, Karin	Micropalaeontology/Palynology	GeoB/MARUM	NL
Baumann, Karl-Heinz	Sedimentology	GeoB/MARUM	D
Clotten, Caroline	Micropalaeontology/Palynology	MARUM	D
Donner, Barbara	General and Marine Geology	MARUM	D
Gray, Daniel	Organic geochemistry	MARUM	SA
Iwanczuk, Natalie	Micropalaeontology	Univ. Tübingen	D
Lombrock, Jonas	Geochemistry	MARUM	D
Mourati, Eugenia	Sedimentology	IGME	Greek
Theodor, Marc	Micropalaeontology	Univ. Hamburg	D
Valk, Ole	Micropalaeontology	Univ. Hamburg	D
Gerard, Versteegh	Organic geochemistry	MARUM	NL

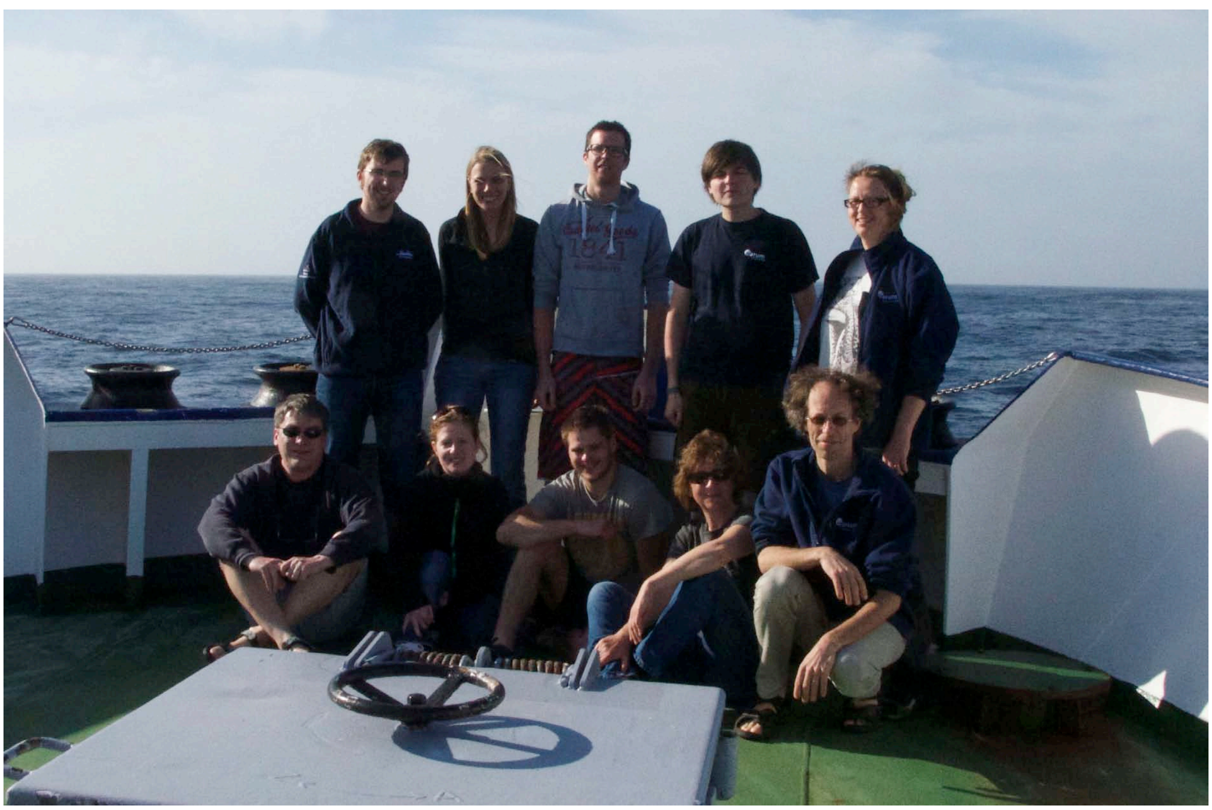

Figure 1. Cruise participants of P488.

2. Research Program

2.1. Summary

This cruise has been carried out within the frame of three differential national and international scientific programs that are being coordinated at the MARUM/Geoscience department of the University of Bremen:

1. Research consortium ANTEM (Anthropogenic and Natural forcing of the European Mediterranean climate in the last 5 Millennia) Project coordinator: PD. Dr. K. Zonneveld. Cooperation between the University Hamburg (Prof. G. Schmiedl, Prof. K. Emeis), MPI Hamburg (Dr. U. Mikolajewicz), GFZ Potsdam (Prof. A. Brauer), Univ. Leipzig (Prof. W. Ehrmann), Univ. Tübingen, PD. H. Schulz, Univ. Utercht (NL, Prof. G. de Lange), ETH Zürich, Prof. S. Bernasconi).
2. The DFG Funded Heisenberg Project „Biogeomolecules" (Assessment of the formation, modification and degradation of marine kerogen at a molecular level) cooperating with the MARUM research area „Geosphere and Biosphere Interactions"
Project coordinator: Dr. G. Versteegh.
3. European Research Council granted project „DARCLIFE" (Deep subsurface archaea: carbon cycle, life strategies and role in sedimentary ecosystems) cooperating with the MARUM research area „Geosphere - biosphere interactions"
Project coordinator: Prof. K-U Hinrichs.

The following aims are being addressed:

1. Characterisation of river-specific chemical, isotopical, organic geochemical, mineral and palynological compositions of the discharge waters of the Po, Foglia, Potenza and Pescara rivers, the so called 'Apennine' and 'Padane' flux parts of the Adriatic Coastal Current around the Gargano peninsula and the distal end of the River-discharge plume in the Gulf of Taranto.
2. Characterisation of rates of selective organic matter degradation and its effects on organic matter based proxies, palynomorphs and kerogen composition along strong gradients in bottom and pore water oxygen concentrations as is present in eastern Italian river plumes and the central Mediterranean Discovery Basin and its surroundings.
3. Characterisation of rates of selective organic matter degradation and its effects on organic matter based proxies, palynomorphs and kerogen composition along oxygen diffusion gradients along „burn-down" intervals of the upper part of the S1 sapropel and „burn-up" events present in discovery Basin core material.
4. Collection of sedimentary material along gradients of differential organic matter degradation as basis for incubation experiments.
5. Characterisation of the geochemical and archaean content of mud-volcano surface sediments in the brine filled Urania Basin as well as obtaining information on the structural and isotopic properties of sedimentary lipids of archaea in this setting.
6. Collecting living planktic foraminifera for culture experiments and their genetic characterisation.

During the cruise material has been collected from three research area's; a. Adriatic Sea, b. Discovery and Urania Basin, c. Golf of Taranto.

a. Adriatic Sea. To address research question 1, upper sediments, suspended matter load, water characteristics and water samples have been collected along transects located perpendicular to the coast, downstream the major eastern Italian rivers. Samples and information has been collected with a multicorer device, gravity corer, in-situ pumps, CTD and Rosette. Exact locations of the stations had been determined previous to the cruise based on satellite images and literature-based information about clay-depocenters in the vicinity of the river mouths. To address research questions 2 and 4, surface sediments have been sampled with a multicorer along transects of differential bottom water oxygen concentrations. Oxygen concentrations of sediments have been determined with Clark-type oxygen microsensors. To address question 6, plankton has been collected at the stations located at distal end of the transects perpendicular to the coast in the central Adriatic Basin and in the central ionian Basin by means of a multi-planctonnet. Despite only partly optimal functioning Multicorer, all previously planned research activities in research area could successfully be executed.

b. Urania Basin, Discovery Basin. To address research questions 2, 3, and 4 sediments have been collected from the anoxic brine environment of the discovery Basin and its oxic surrounding. Sediment sampling with the Multicorer has been successful. Unfortunately at the oxic station the wire of Winch 3 broke leading to the loss of the gravity coring device and several meters of cable.

   To address research aim 5 volcanic mud has been collected from the suspended mud layer close to the ocean floor as well as from bottom sediments at the sample location near the centre of the volcano using Niskin Bottels.

   Research question 6 has been addressed by collecting plankton at several stations of the upper water column in the vicinity of the Urania and Discovery Basins as well along a transect towards the Golf of Taranto.

c. Golf of Taranto. To obtain information about the suspended matter load, water characteristics and surface sediment characteristics of the most distal part of the Po-river discharge plume, sediments, suspended matter load and water column characteristics and surface waters have been collected along a transect along the river plume track. Although sample collection has been successful the timing of the cruise appeared to be to early in the season to obtain a clear signal as river discharge is at a minimum in early March. Only in the most southern Station some slight traces of discharge waters could be discovered.

2.2. Introduction.

Research activities performed during cruise P448 formed basic investigations for three research projects of which the coordination and major exploitation is hosted at the MARUM: 1. activities of the “ANTEM-consortium“ (Anthropogenic and Natural forcing of the European Mediterranean climate in the last 5 Millennia) where scientist of the MARUM cooperate with the MPI Hamburg, GFZ Potsdam Univ. Hamburg, Univ. Leipzig, Univ. Tübingen, ETH Zürich (CH) and the Univ. Utrecht (NL), 2. „Biogeomolecules“ (Assessment of the formation, modification and degradation of marine kerogen at a molecular level) and 3. “DARCLIFE“, Deep subsurface ARchaea: Carbon cycle, LIFE strategies and role in sedimentary ecosystems.

2.2.1 ANTEM

The international ANTEM research consortium (**A**nthropogenic and **N**atural forcing of **T**he **E**uropean **M**editerranean climate in the last 5 millennia) aims to develop, test and apply tools to determine the rate of natural and anthropogenic forcing of the marine coastal environment and climate in the Southern Italian region during the last 5000 years. This is achieved by applying a new iterative workflow that integrates high-resolution marine and lacustrine proxy studies with physical ocean-biogeochemical model experiments. It is hypothesized that late Holocene sub-decadal to millennial changes in the South Italian marine coastal ecosystems represent high-amplitude responses to the large-scale climate processes of the North Atlantic regime but the natural signals have been modified by anthropogenic changes in land-use and industry resulting in marked environmental perturbations notably in the last 60 years. For an adequate estimation of the rate of human and natural forcing, detailed information is required about changes in key-parameters of the climate and environment of this system such as temperature, salinity, trophic state of the upper marine waters and bottom-water redox state as well as human activity in the region.

Within the consortium four studies envisaged that combine (a) a physical ocean-biogeochemical model for the South Italian coastal region that enables modelling synthetic sediment cores, (b) organic geochemical methods that provide detailed information about high temporal variability in the climatic parameters temperature and the precipitation/ evaporation balance, (c) palynological tools to determine human activity and marine environmental change and (d) sedimentary tools to establish detailed tephra based chronologies and reconstruct changes in the marine and terrestrial environments for the last 5 ka.

Each individual project provides insights into the rates of change of natural and human activities influencing the above mentioned key parameters of the system in focus. By integrating the individual studies using an iterative workflow in which proxy and model outcome are tuned and optimised, a higher accuracy of proxy and model outcome will be reached.

For these projects marine core material of unique quality is needed that allows the generation of the above mentioned information for the last 5 millennia with a temporal resolution of three years. These core sites are located downwind South Italian volcanoes. Robust and independent chronologies supported by tephrochronology will ensure the precise correlation of the records. This allows the scientific activities to be precisely focussed on time intervals of large environmental and climate change, such as the pre-industrial - industrial transition (last 200 years), the Little Ice Age, the Medieval Climate Anomaly, the Roman Climate Optimum and the Homeric Transition. For the research area the world-wide longest instrumental data series are available of River discharge (daily measurements of the last 200 years) and central Italian air temperature (from 1654 onward)

2.2.2. Biogeomolecules and DARCLIFE

Sedimentary organic matter (OM) is by far the largest organic carbon pool. It consists predominantly (95%) of kerogen; a poorly understood heterogeneous pool of resistant and complex polymeric bio- and geo-macromolecules, insoluble in common organic solvents. In the marine environment it is composed of material derived from the various plankton species that comprise the ecology of primary producers and consumers in overlying surface waters. It is also composed of allochthonous materials introduced erosionally from the land by fluvial and eolian transport processes, products from chemical transformations and condensation reactions, as well as re-synthesis products derived from heterotrophic microbial activity that drives OM decomposition during diagenesis. Only a fraction of the organic material that is produced within the upper water column reaches the sea floor, where it is further degraded by aerobic and anaerobic remineralisation processes and it has been estimated that roughly only about 1% of the originally produced OM might be transferred to the deep biosphere (e.g. Suess, 1980; Hedges; Keil, 1995; Middelburg; Meysman, 2007).

During the last few decades it has become clear that preservation is highly selective, and that the amount and composition of OM preserved in marine sediments varies greatly among regions and depositional environments. Marine sedimentary OM forms the basis of many proxies used for reconstructing climate and environment. Since these proxies often provide the foundation for these reconstructions, it is essential to have detailed information about the character and influence of selective preservation on them. The chemical, physical and biological effects on OM degradation as well as the effect of selective degradation on proxy reliability are key topics within a large number of scientific research disciplines.

Research activities that have been carried out during P448 aim to shed more light on the genesis, nature, modification and degradation of marine kerogen and its effect on OM based proxies. For this we intent to compare the production, composition and geochemical character of particulate organic matter in the water column as well as taphonomic processes in the sediment. Focus will be the characterisation of differential input sources of differential river systems and the linking of recent and fossil kerogen particles to their biological sources through combining particle morphology and bio(geo)chemistry (e.g. Versteegh et al., 2010), by focusing on natural and experimental kerogen formation in relation to OM degradation by means of sediment analyses and incubation experiments (e.g. Kim et al., 2009; Bogus et al., 2012). This later topic requires quantification of OM degradation and modification rates over time scales of years to tens of millennia for different, depositional environments and redox conditions whereby the process rates deduced from sediment analyses need to be calibrated by experiments carried out under standard conditions in the laboratory.

The research areas of the CAPRICCIO cruise are characterised by such differential depositional environments. The anoxic Discovery Basin and adjacent oxic depositional environments in the central Eastern Mediterranean provide deep water, fully marine, low sedimentation rate and oligotrophic end-member with large differences in redox conditions and organic matter oxygen exposure times, today. Recently water samples, surface sediments and core material from two core locations in the central parts of the Urania and Discovery Basin have been collected during F.S. METEOR Expedition M84/1 (Feb. 2011, Zabel et al., subm) within the frame of the European Research council funded project „DARCLIFE“ (Deep subsurface archaea: carbon cycle, life strategies and role in sedimentary ecosystems). CTD profiling confirmed the position of the interface between oxic intermediate waters and anoxic brine waters as archived earlier during the R.V. Pelagia Cruise „DOPPIO“ (Deep Ocean Palaeoenvironmental and bottom topography Palaeoclimatic records from the IOnian Sea) carried out in November 2008 by members of the ANTEM consortium (De Lange, 2009 internal report).

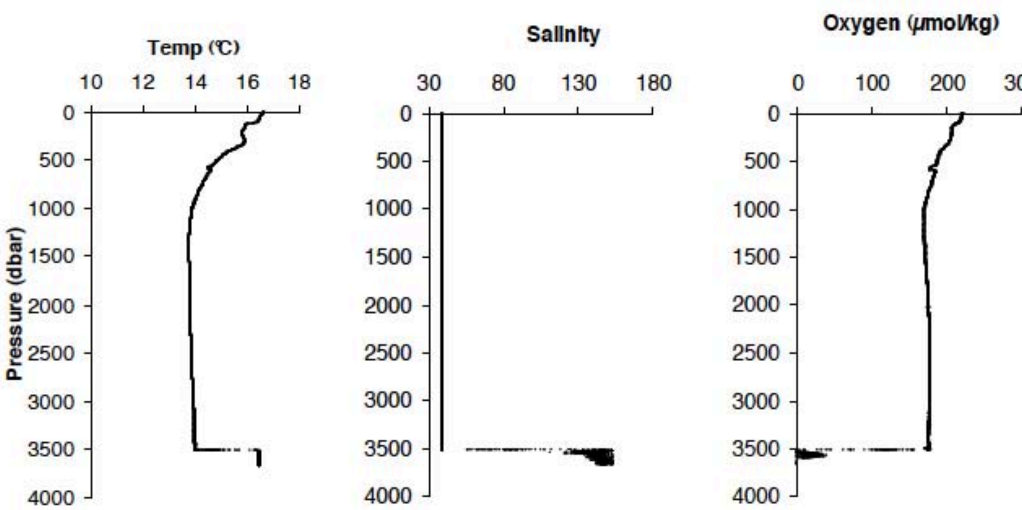

Fig. 2. CTD data of station GeoB 15101 (Urania Basin) from Zabel et al. (subm).

Core material from the Urania Basin contains mud-volcanic sediments. Core material from the discovery Basin contains sections of laminated sediments deposited under anoxic conditions alternated by sediments deposited under oxic conditions which are interpreted to reflect differential ventilation events (Fig. 3). Chemical analysis on pore water profiles of multi-cores collected at the same site reveal that the upper 25 cm of the cores are Fe depleted corresponding to a black colour of sediments that show laminated structures, indicating that the sediments are deposited under anoxic conditions ensuring optimal preservation of organic material. These sediments are interrupted by bright coloured sediments that are deposited under oxic environments indicating that the basin has been regularly been ventilated. On the transition zones chemical and sedimentary information indicates that post-depositional oxydation of OM has taken place in the cores. This provides excellent sedimentary material to investigate the effects of aerobic degradation on POM and OM based proxies. Unfortunately material collected during M84/1 is extremely limited and no equivalent couterpart sediments are collected from the aerobic settings surrounding the basin. We therefore plan to resample at the same core location as well as nearby sediments.

The eutrophic, terrestrially influenced, high sedimentation rate endmembers can be collected in the Adriatic and Gulf of Taranto. Surface waters of this region are formed by discharge waters of the Po-river and eastern Italian rivers draining the Apennines. Below the discharge waters and adjacent water masses strong contrast in bottom water redox conditions and sedimentation rates exist with good OM preservation in the plume influenced regions. The sedimentary archives in this area enables the assessment of the impact of water depth, sedimentation rate/oxygen exposure time and terrestrial influence on OM degradation. Furthermore, sediments from both „endmember“ systems in the brine basin and along the Italian coast will provides the necessary amount of „fresh sediment“ material to quantify OM degradation and relate this to the kerogen composition at a molecular level for a wide range of environmental conditions in the field and in standardised laboratory incubations.

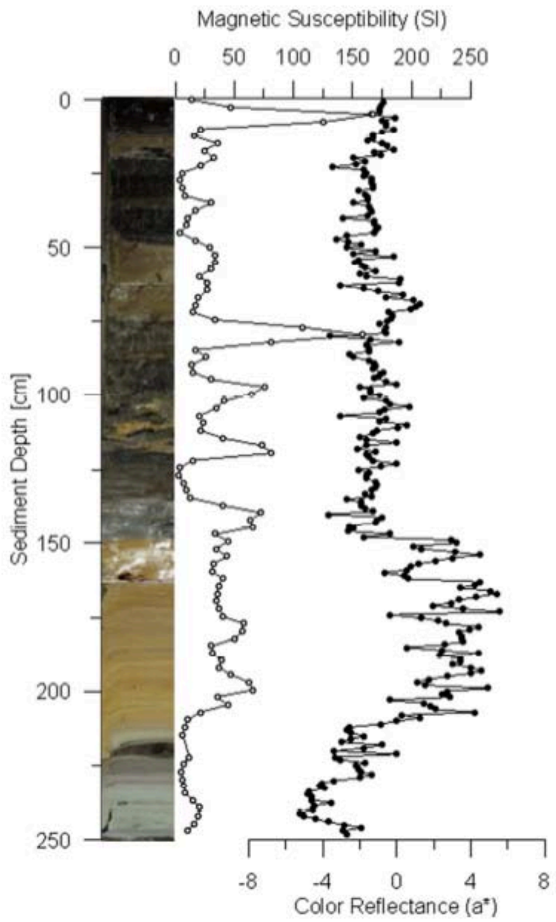

Fig. 3. Photo-mosaic, magnetic susceptibility and colour reflectance for core GeoB 15102-1 (Discovery Basin), from Zabel et al. (subm).

2.2. Aims.

1. Characterisation of river-specific chemical, isotopical, organic geochemical, mineral and palynological compositions of the discharge waters of the Po, Foglia, Potenza and Pescara rivers, the so called ‘Apennine’ and ‘Padane’ flux parts of the Adriatic Coastal Current around the Gargano peninsula and the distal end of the River-discharge plume in the Gulf of Taranto.
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4. Collection of sedimentary material along gradients of differential organic matter degradation as basis for incubation experiments.
5. Characterisation of the archaean content of mud-volcano surface sediments in the brine filled Urania Basin as well as obtaining information on the structural and isotopic properties of sedimentary lipids of archaea in this setting.
6. Collecting living planktic foraminifera for culture experiments and genetic characterisation.

3. Research program and Cruise track

The research program has been carried out within three research areas (Fig. 4).

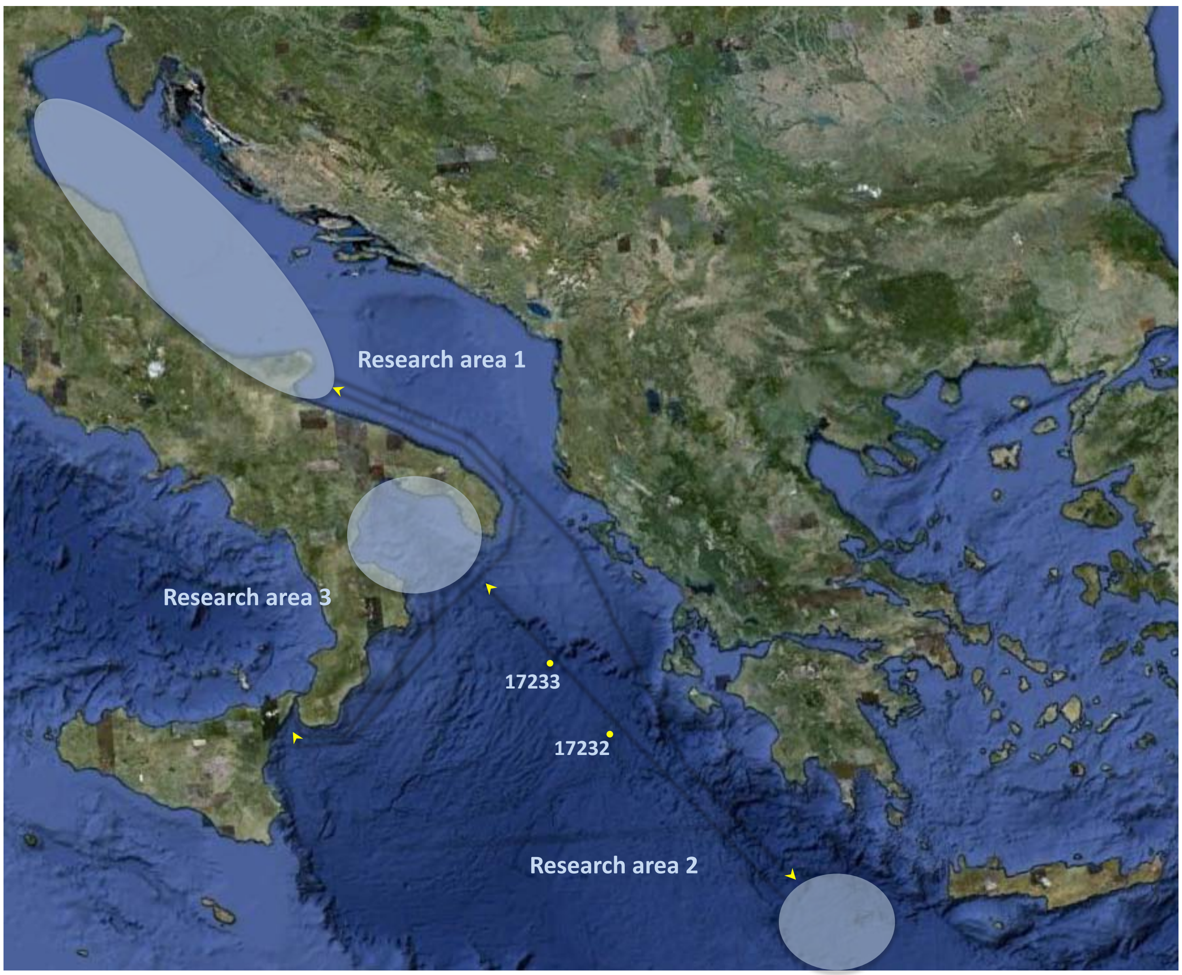


Fig. 4. Map of the Eastern Mediterranean Sea with cruise track, research areas and stations of the central Ionian Sea. For detailed maps of research area‘s 1/3 and 2 see Fig. 5 and 6 respectively.

3.1. The Adriatic Sea

To obtain information about the differential signatures of discharge waters of the Po-river and eastern Italian rivers draining the Apennines the activities have been focussed on five transects (Fig. 5). The first transect is positioned perpendicular to the coast in the discharge plume of the Po arms: Po della Pila and Po della Tolle that together are responsible for 71% of the Po-discharge. The ”river“ transects are located more or less perpendicular to the Italian coast, successively downstream of the river mouths of the

Foglia, Potenza, Pescara and north of the Gargano peninsula. These transects cover the sediment loaded eutrophic river-plume waters of the so called ”Apennine flux“, the more offshore ”Padane flux“ and the oligotrophic waters even further offshore in the Adriatic (Fig. 5). The transect 5 located around the Gargano peninsula is positioned more or less parallel to the coastline following the path of the discharge plume waters from the position where both ”fluxes“ are still well traced north of the peninsula into the region where the signals mix and gradually become less pronounced south of the peninsula in the Gulf of Manfredonia (Fig. 5).

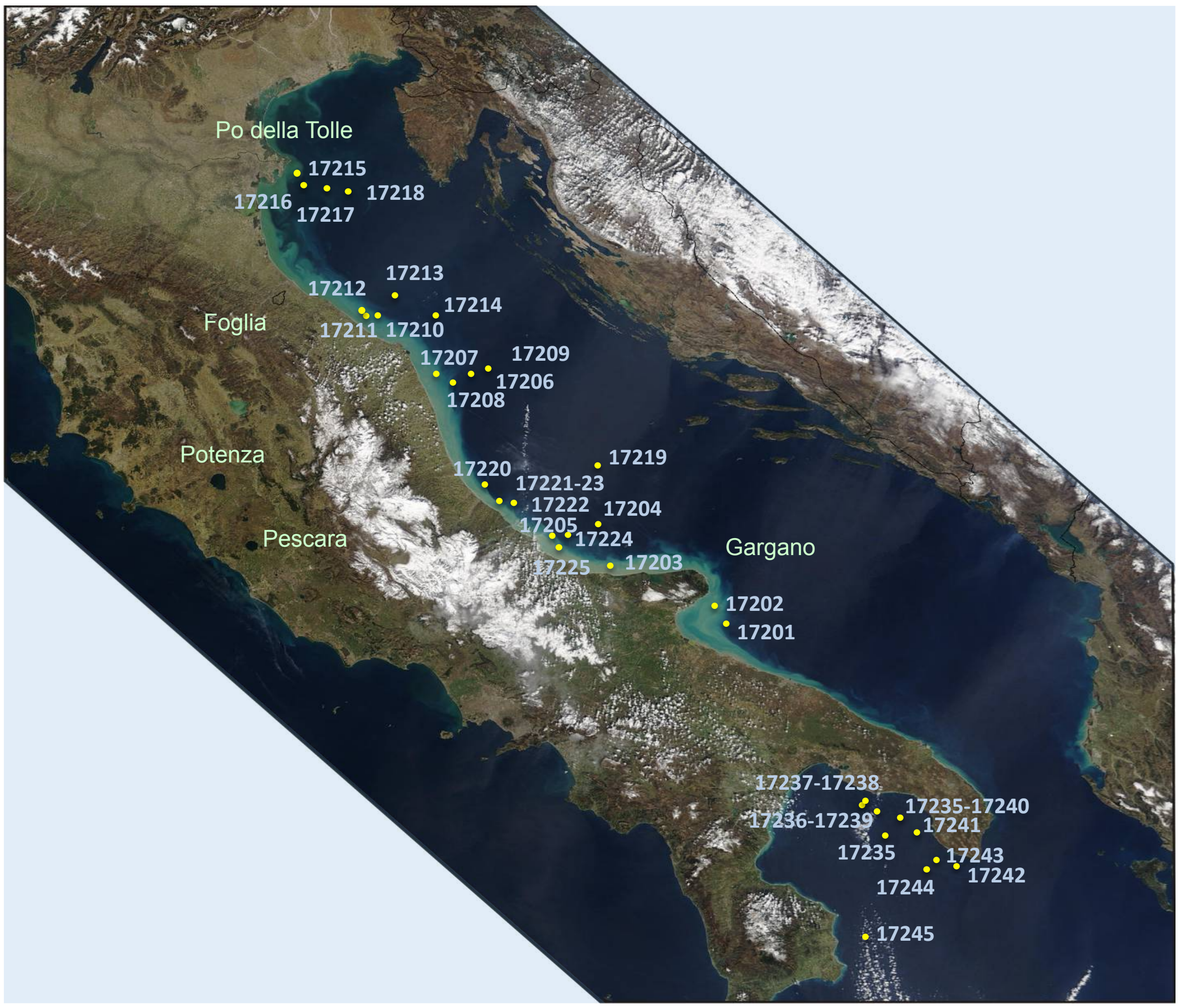


Figure 5. Satellite image of 10 April 2010 showing suspended matter discharge by the Po river and eastern Italian rivers draining the Alps with station positions of cruise P448 in research areas 1 and 3.

3.2. Discovery and Urania Basins.

Here the surface sediments and core material have been collected along a transect from the anoxic parts of the central „brine“ waters of the Discovery Basin towards the well ventilated bottom-water environments along the margins of the basin (Fig. 6). Furthermore, „mudvolcanic“ sediment material of the central part of the Urania Basin is sampled for future incubation experiments. The exact location of the core positions is determined based on a bathymetric profiling carried out at the R.V. Pelagia in 2008 (de Lange et al., internal report).
During the transit to research area, the upper water column has been sampled at 3 stations with a Multinet to collect the planctic foraminiferal content of the water column.

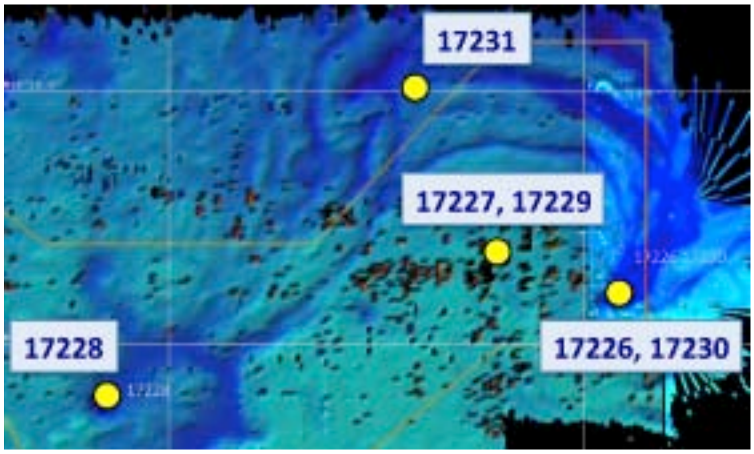


Fig. 6. Bathymetric map of the ocean floor of research area 2 after de Lange et al. (2008 internal report) showing station positions.

3.3. The Gulf of Taranto.

To assess the chemical, organic-geochemical, physical, micro-palaeontological, palynology, microbiological and sedimentological properties of the most distal part of the river plume extension, we sampled additional surface sediments, upper waters and suspended matter along a transect covering the transition between the river plume waters and the Ionian Sea Surface waters, the latter being the water mass in the centre and most northern part of the Gulf of Taranto (Fig. 5).

4. Water column sampling

4.1. Ocean circulation
(Karin Zonneveld)

The Adriatic Sea and the Golfo di Taranto are two side-basins of the Eastern Mediterranean Sea (Fig. 7). The Adriatic Sea is land-locked by Italy in the west and Balkan countries in the east whereas the Golfo di Taranto is land-locked at three sides by the southern part of Italy. The oceanographic current systems of both basins are strongly related to each other and to that of the eastern Mediterranean Sea. Surface waters at the eastern side of the Golfo di Taranto and the western part of the Adriatic Sea are formed by the same water mass that finds its origin in the north-western North Adriatic Sea. Here large amounts of discharge waters from the Po-River and northern Italian rivers enter the marine system (e.g. Boldrin et al., 2005; Syvitski and Kettner, 2007). The Po River is the largest Italian river draining the southern part of the Alps and northern part of the Apennines. It enters the north-western North Adriatic Sea through a deltaic system. The major part of its catchment area, the so-called Po-valley, is intensely used for agriculture and industry and it‘s large cities of Milano, Venezia and Torino inhabit the majority of the Italian population.

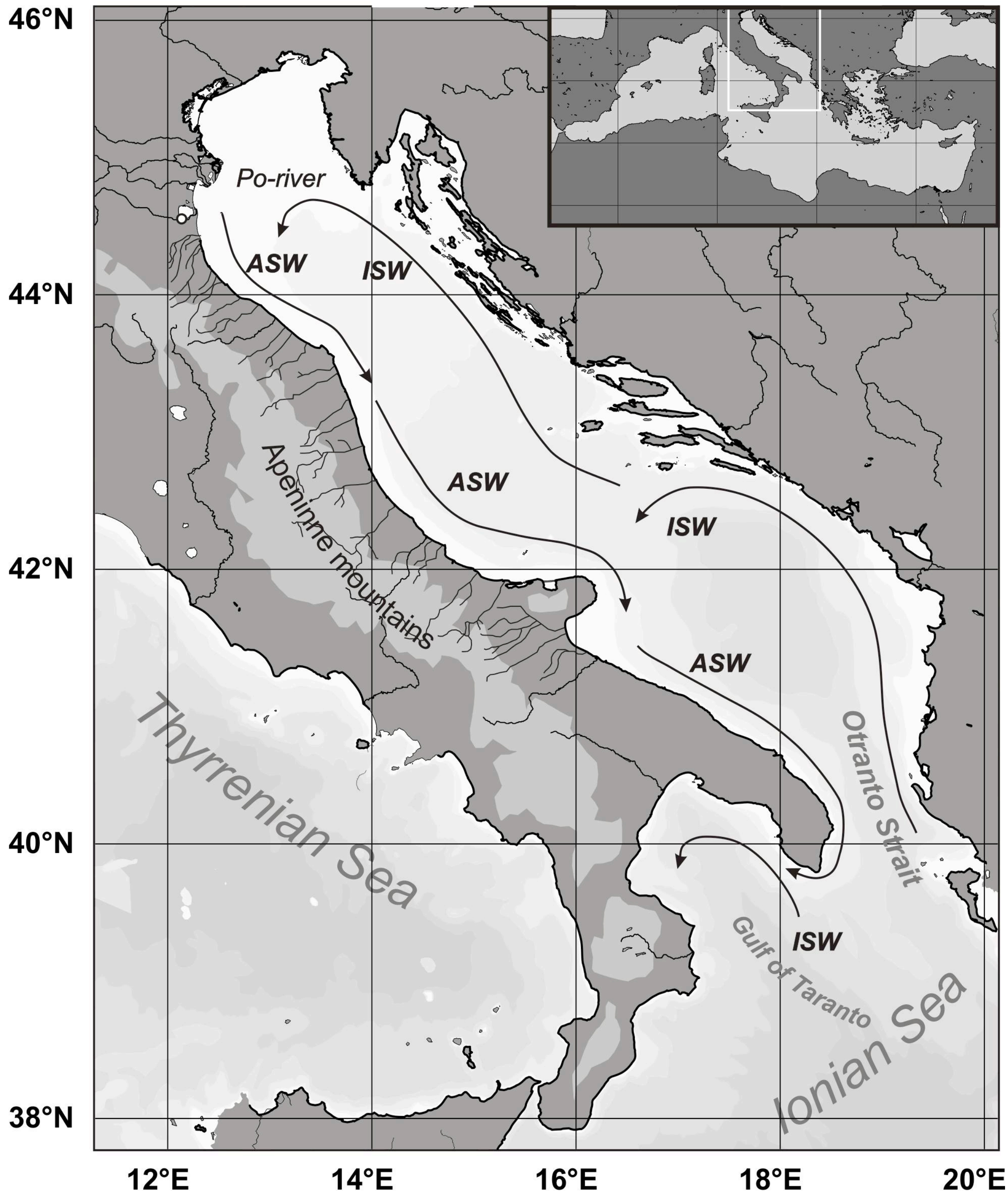


Fig. 7. Map of research area 1 and 3 with surface current circulation (redrawn after Leider et al., 2010).

As a result of the anti-clockwise surface water circulation induced by Coriolis forcing, the fresh, nutrient and sediment rich discharge waters are pressed against the western coastal margin of the Adriatic Sea (e.g. Lee et al., 2007; Orlic, 2009 and references therein). The discharge waters that enter the marine realm have a clear sedimentological, physical and biological character such as high chlorophyll-a concentrations (Fig. 8). A band of these waters can be traced along the whole western margin of the Adriatic Sea, the Strait of Otranto and around the Calabrian Peninsula into the Golfo di Taranto. Classically these waters are classified as Adriatic Surface Water (ASW). Along their way southward, the plume waters are additionally spiced by sediment loaded, fresh, nutrient and element rich waters from local eastern Italian rivers draining the easten side of the Apennines. Although the loads of nutrients and sediments of these local rivers are considerably lower with respect to the Po River discharge their sedimentary signal can be traced clearly in the most coast-near waters whereas the Po discharge signal can be traced in the more offshore parts of the coastal discharge plume (e.g. Milligan and Cattaneo, 2007, Tomadin, 2000). These differential sedimentary signals can be traced as far as the Gargano Peninsula whereas further south the plume-waters are characterised by a mixed signal. South of the Gargano peninsula the Golfo di Manfredonia is located. The water depth of this small basin is relatively shallow but increases significantly in seaward direction beyond the 30m isobath. Surface waters are formed by the AWS that show a cyclonic circulation inside the Gulf and a southwestward direction at its outer rim.

Fig. 8. Satellite image of the Adriatic Sea and Gulf of Taranto showing winter/spring chlorophyll-a concentrations in surface waters. Red colours represent high chlorophyll-a concentrations, blue colours represent low concentrations. (source: image of the day archive NOAA).

The surface waters of the central and eastern side of the Adriatic Sea are formed by the oligotrophic Ionian Sea surface waters that enter the basin through the Strait of Otranto (Fig. 7). They are pressed against the most offshore side of the river plume waters slowly mixing with the ASW on their ways southwestward.

Within the Golfo di Taranto, the circulation is cyclonic with both ASW and ISW entering along the eastern part the basin. Within this gulf both water masses mix with ASW being characteristically traceable as far north as the city of Taranto (Boldrin et al., 2005; Lee et al., 2007). The surface circulation and the extension of the ASW plume are strongly dependent on the seasonal cycles, with ISW invading the basin in late winter and early spring. In late spring, summer and autumn, ASW enters the basin from the south-east along the Calabrian margin. Maximal influx of ASW can be observed in late spring and autumn related to enhanced Po River discharge outflow due to the melting of snow and ice in the Alps and Apennines in spring and enhanced precipitation in autumn. During winter enhanced mixing between the oligotrophic ISW and more nutrient enriched LIW results in locally enhanced phytoplankton production in the upper waters. Nutrients and trace elements in the research area not only introduced by the ASW and by winter mixing, but also by the deposition of volcanic ash and the input of Sahara-Sahel dust (Eker-Develi et al., 2006; Langmann et al., 2010; Stuut et al., 2009). Aeolian dust is brought into the system by a northward wind called the Sirocco. The Sirocco tends to occur year round without a favoured season although strong gale-forced Sirocco‘s are most common during the spring (Pasaric et al., 2007).

Intermediate waters of both the Adriatic Sea and the Golf of Taranto that reside between 150 and 600 m water depth, are formed by Levantine Intermediate Waters (LIW) originating from the Levantine basin (Greece). In winter these waters mix with the ISW in the Adriatic Sea to form Adriatic Deep Water that in turn forms a considerable part of the dense Eastern Mediterranean Deep Water (EMDW) that is represented by the deep water masses of the Golf of Taranto below about 600m water depth (e.g. Hainbucher et al., 2006; Sellschopp and Alvarez, 2003).

Surface waters in the Discovery and Urania Basin regions are formed by northwesteward flowing ISW waters. Comparable to the Adriatic Sea and the Golf of Taranto, intermediate waters are formed by LIW that overlay EMDW. Below 3500 m water depth, waters in both Basins are formed by high salinity oxygen depleted brine waters.

4.2. CTD profiling

(Karl-Heinz Baumann and Karin Zonneveld)

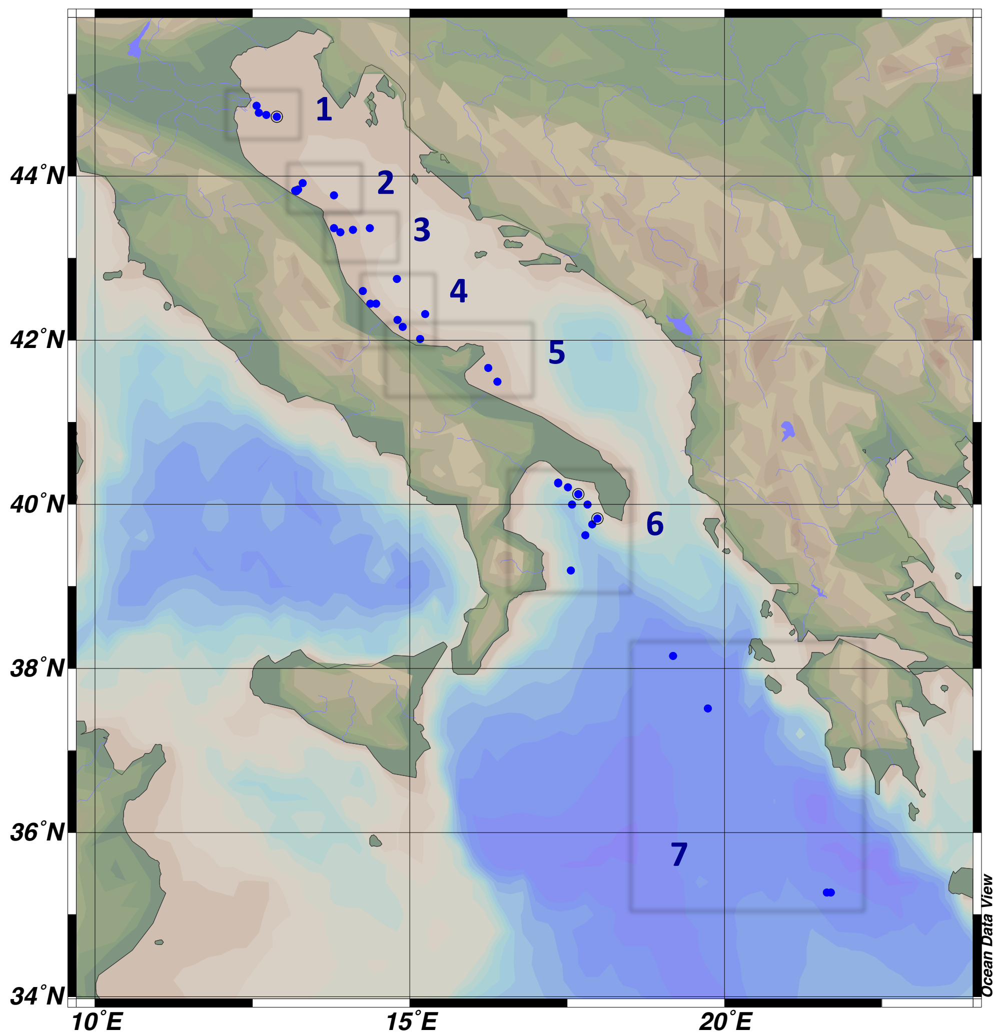


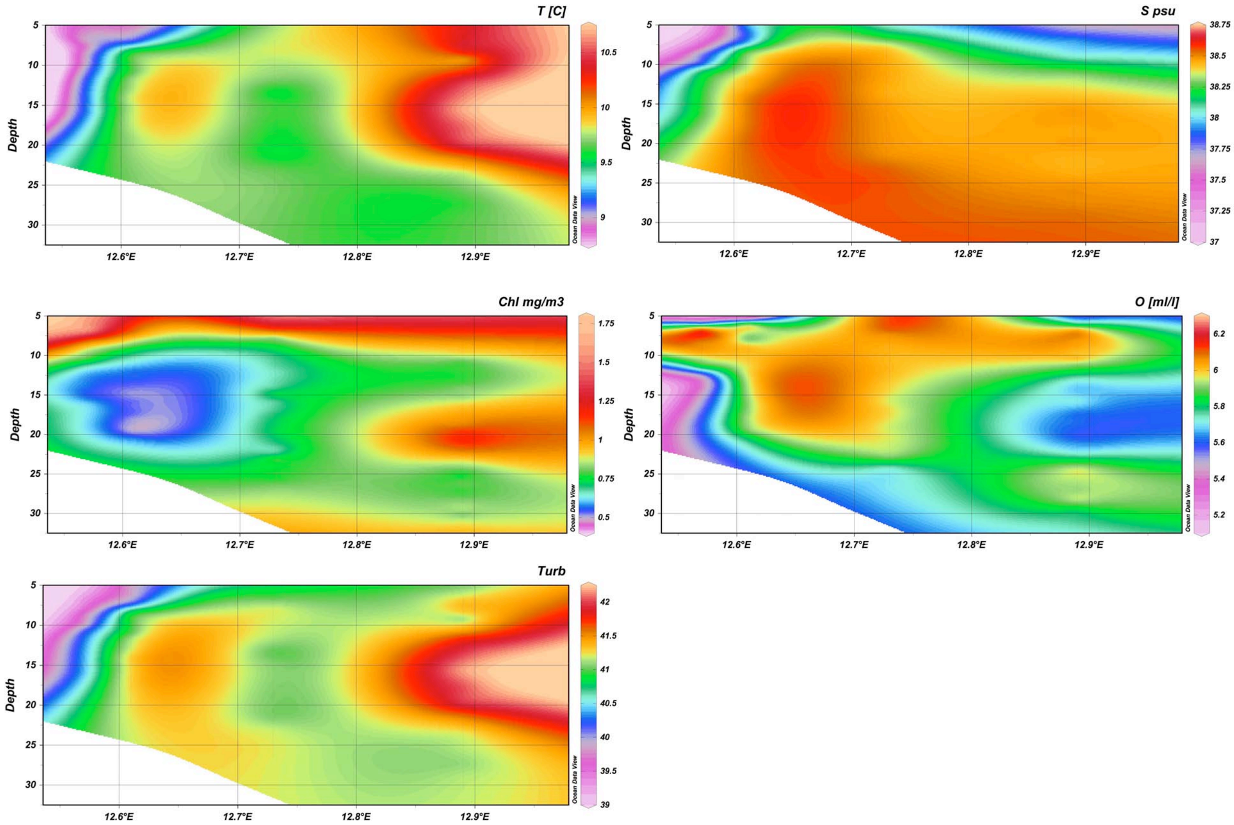
Fig. 9. Map of the research area depicting positions of CTD stations and transects.

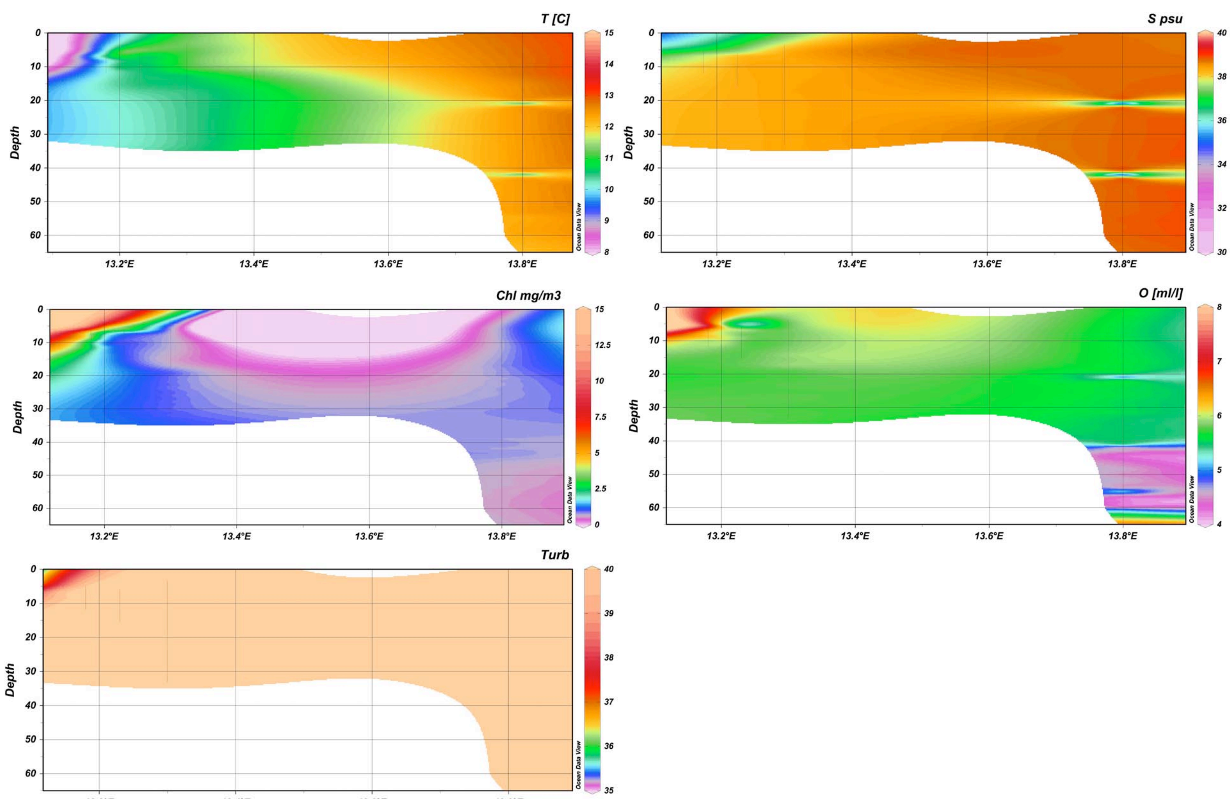
Thirtysix Seabird SBE 9plus-CTD profiles were acquired (Table 2, Fig. 9) during the cruise. The CTD profiler was equipped with sensors for temperature, salinity as well as oxygen and was launched together with the multiple water collectors (rosette with 12 x 10 l bottles). Additionally, a WETLABS fluorometer and a WETLABS turbidity sensor were attached to the CTD. The chlorophyll concentrations of the fluorometer were used for the detection of the (deep) chlorophyll maximum, whereas the turbidity sensor gave information about nepheloid layers in the water column. Both helped to identify sample depths for in-situ pumps (see chapter 4.3). Water samples of generally 3-8 l were only taken for investigation of coccolithophorid assemblages (see chapter 4.5).

Table 2. List of Rosette-/CTD-profiles and water depths of profiles. Water samples were taken for coccolithophorid counts.

Date	Station No. GeoB	Latitude (N)	Longitude (E)	Bottom depth (m)	Water depths of profile (m)	Remarks
08.03.13	17201-1	41° 30,30'	16° 24,05'		45	
	17202-1	41° 39,98'	16° 14,98'	14,2	10	
09.03.13	17203-1	42° 01,30'	15° 10,31'	29,4	25	
	17204-1	42° 19,01'	15° 14,98'	125,6	120	no data file!
	17204-2	42° 18,99'	15° 14,99'	127	120	bottle 4 not closed
	17205-1	42° 14,99'	14° 48,32'	60,2	50	bottle 4 not closed
10.03.13	17206-1	43° 21,01'	14° 05,98'	61	55	
	17207-1	43° 22,00'	13° 48,02'	12,5	10	
	17208-1	43° 19,02'	13° 53,97'	16,7	15	
	17209-1	43° 22,29'	14° 21,96'	85,6	80	
11.03.13	17210-1	43° 54,97'	13° 17,99'	39,7	35	
	17211-1	43° 49,27'	13° 12,07'	12,6	12	
	17212-1	43° 50,07'	13° 10,59'	14	12	
	17213-1	43° 50,31'	13° 13,96'	14,9	14	
	17214-1	43° 46,00'	13° 47,97'	68,1	60	
12.03.13	17215-1	44° 51,33'	12° 34,01'	19	15	
	17216-1	44° 46,97'	12° 36,32'	24,2	20	
	17217-1	44° 45,06'	12° 45,00'	31	25	
	17218-1	44° 43,99'	12° 53,50'	36	30	
13.03.13	17219-1	42° 44,99'	14° 47,96'	197,5	190	
	17220-1	42° 35,98'	14° 15,36'	41,4	35	
	17221-1	42° 27,12'	14° 22,99'	27,0	25	
	17222-1	42° 27,27'	14° 28,01'	67,4	60	bottle 1 not closed
	17225-1	42° 09,98'	14° 54,00'	43,1	40	
17.03.13	17227-3	35° 16,50'	21° 37,97'	3276	3330	bottles not closed
18.03.13	17229-1	35° 17,00'	21° 37,96'	3281	stopped	connection failed
	17230-1	35° 16,46'	21° 41,46'	3527	200	
19.03.13	17232-2	37° 31,14'	19° 44,36'	3384	200	
	17233-1	38° 09,57'	19° 11,26'	3168	200	
20.03.13	17234-2	40° 00,00'	17° 35,01'	910	200	
	17238-1	40° 16,01'	17° 21,48'	324	300	
	17239-1	40° 12,50'	17° 31,50'	194	180	
	17240-1	40° 08,00'	17° 41,04'	178	170	
21.03.13	17241-1	40° 00,00'	17° 49,98'	215	200	
	17242-1	39° 50,02'	17° 58,97'	108	100	
	17243-1	39° 45,55'	17° 53,72'	161	155	

Section 1:
Section 2.





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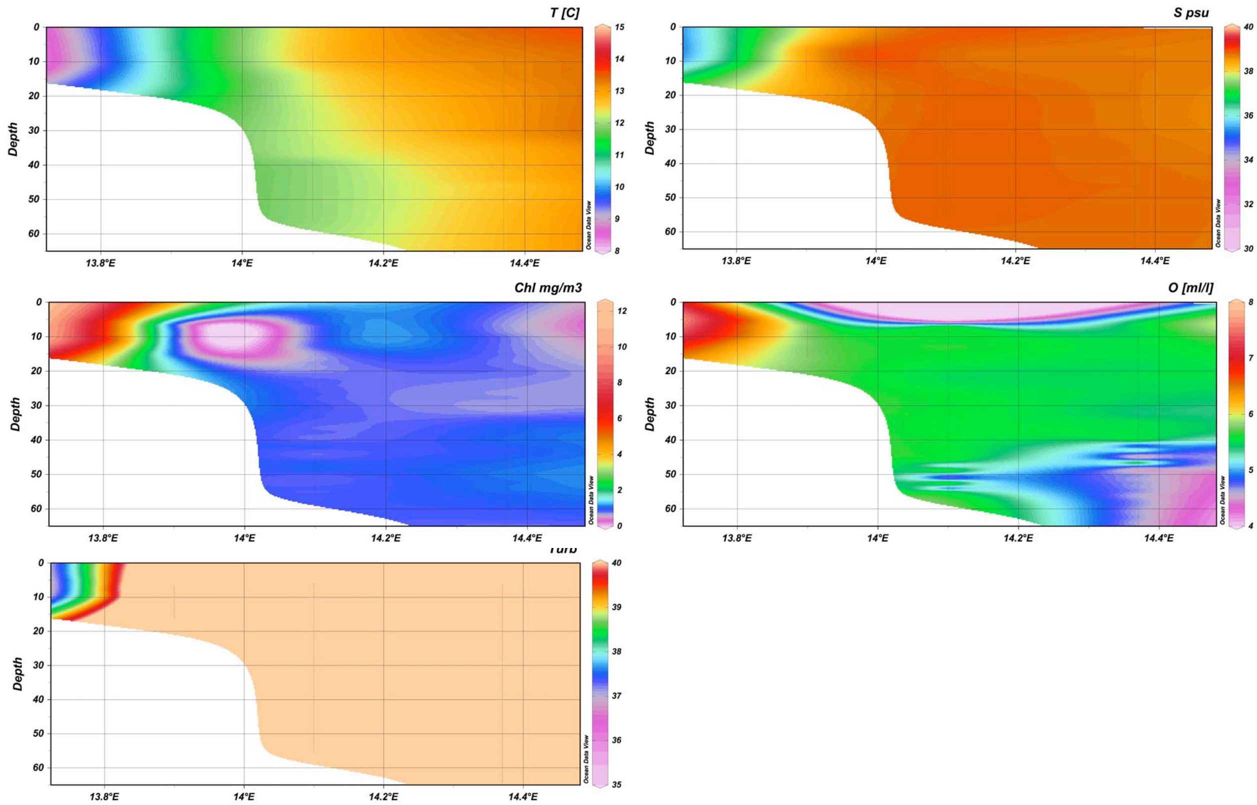

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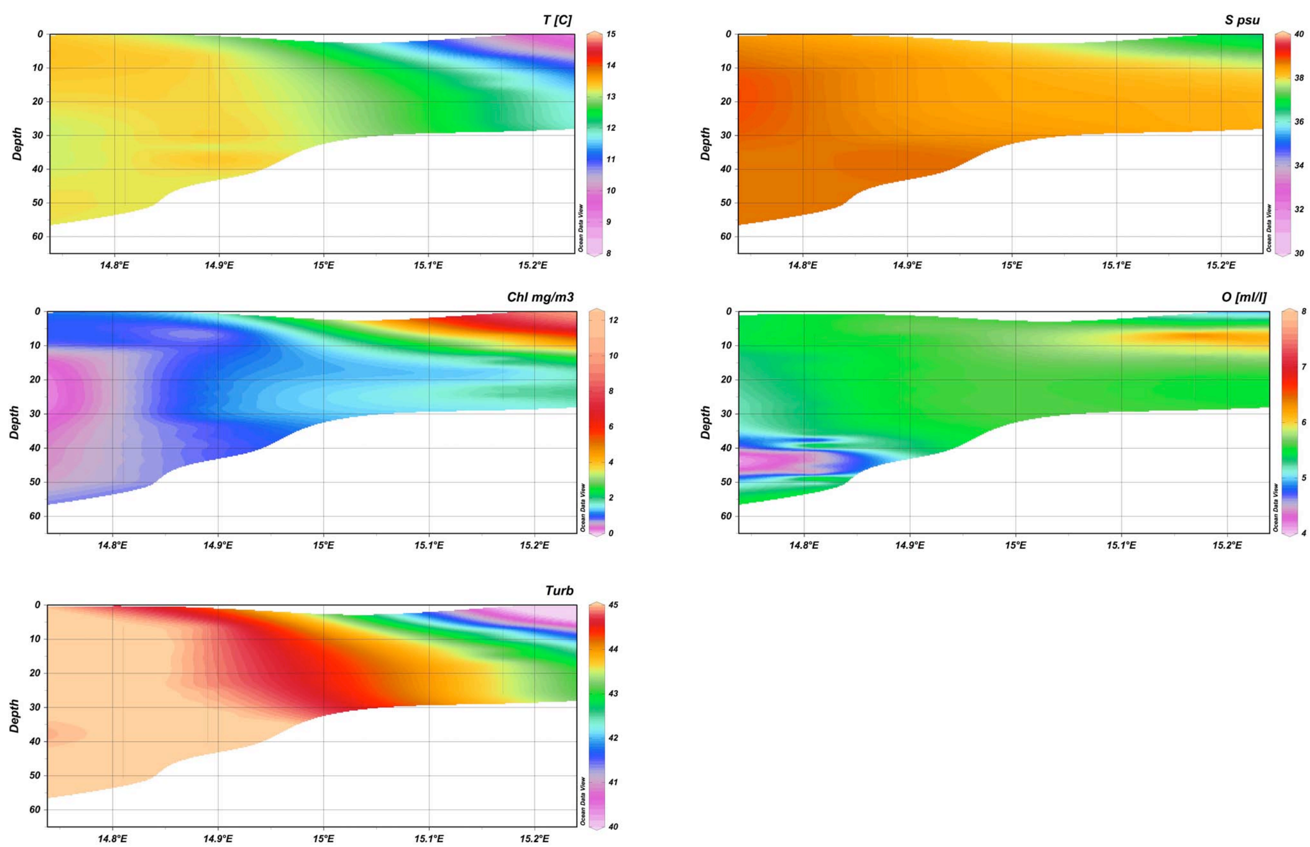

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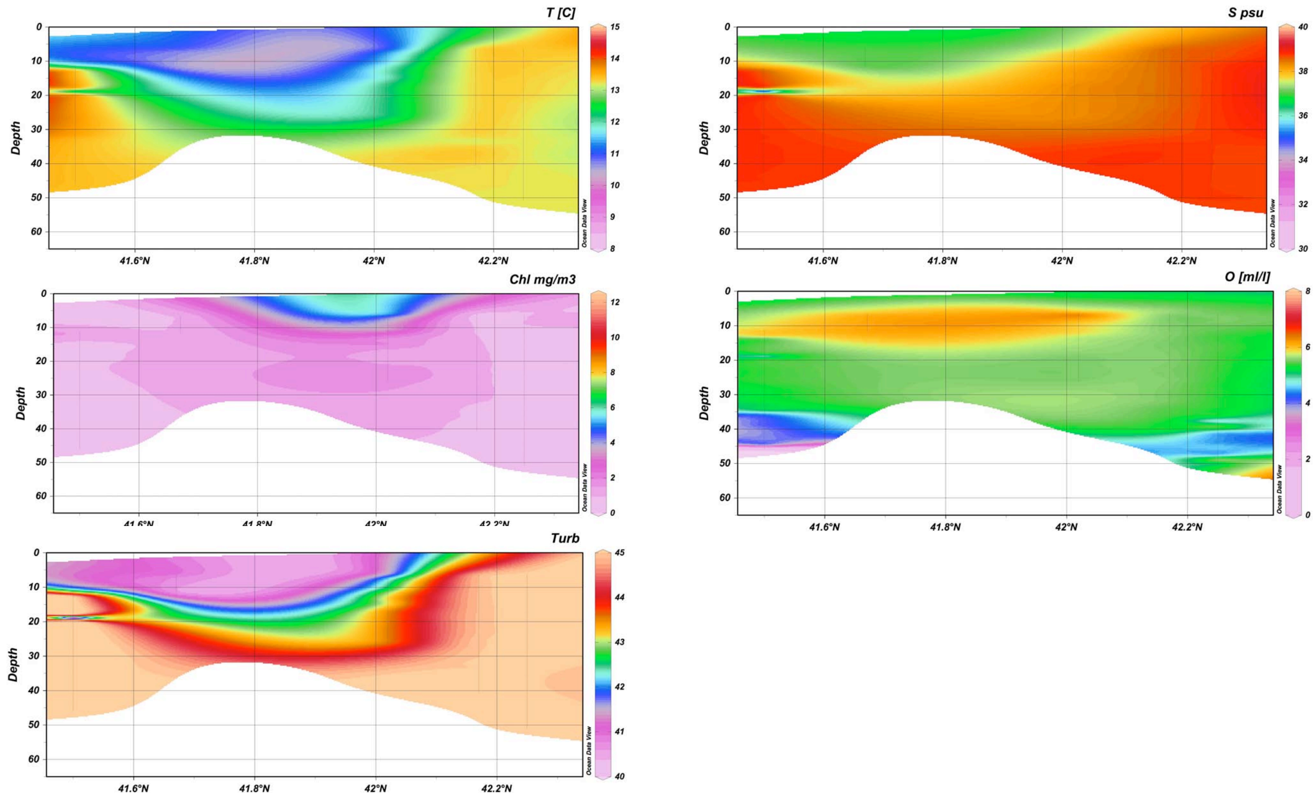

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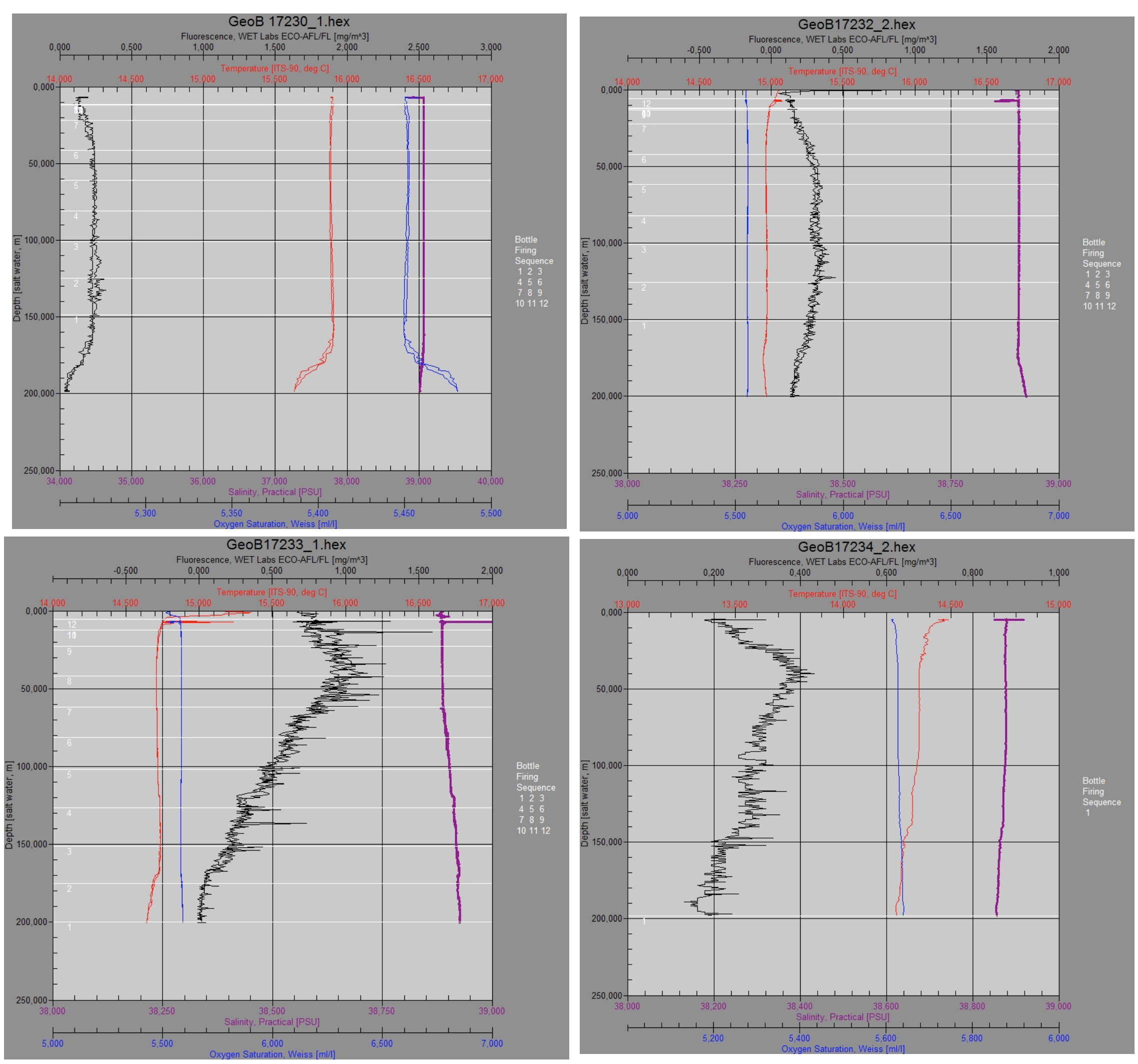

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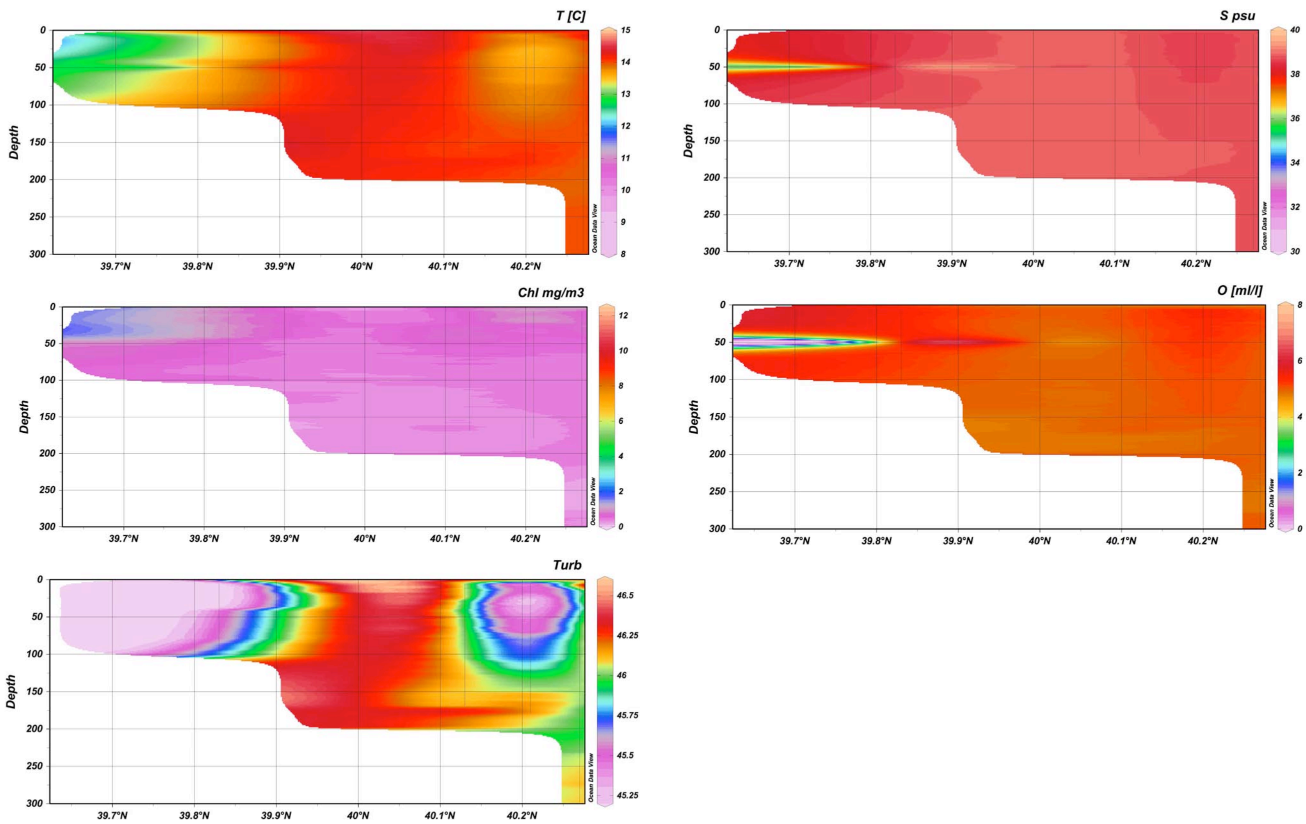


4.4. Multinet sampling

(Barbara Donner, Natalie Iwanczuk)

In order to get information about the species composition of planktonic foraminifers assemblages, sampling with a multinet was conducted. On board the species identification is based on morphological criteria. In the home lab, the results will be specified by genetic analysis. This is part of the monitoring program of Prof. Michal Kucera "Eco-phenotypical and genotypical variability of modern planktonic foraminifera".

The multinet is a Hydro-Bios "Multi Plankton Sampler MPS 92 B", Kiel. Five nets with a mesh size of 200 micrometer were run per hieve, each one sampling in different depth intervals of the water column (Tab. 1). After sampling, the living foraminifer individuals were directly picked out with a brush and the help of a stereomicroscope. Foraminifers were placed in a cardboard plummer cell and immedeatedly frozen at -32°C. The frozen material will be transported back to Bremen in a freezing container. Back in the home lab, a DNA sequence analysis will be run on these samples.

Preliminary results

All multinet deployments were run successfully, no malfunction of the sampler, no nets torn.
Independent of the location or the water depth only very few living foraminifer individuals were found. This was not expected. Two years ago during POSEIDON cruise P 398 in April 2010 a higher number of living foraminifers were caught.

P448: MN deployment	Date / local time	Station number	Lattitude N	Longitude E	Water-depth [m]	Sampling depth [m]	Status	Number of planktic forams, alive	Number of planktic forams, dead	Water-temp. [°C]	Salinity [%o]
Adriatic Sea											
	09.03.13	17204-3	42°18,99	15°15,015	127	120-100	ok	3	0	11.49	38.72
	17:00					100-75	ok	8	0		
						75-50	ok	8	0		
						50-25	ok	25	0		
						25-0	ok	0	4	12.03	38.47
	10.03.13	17209-2	43°22,29	14°21,95	85	75-60	ok	3	0	12.17	38.85
	22:00					60-45	ok	8	0		
						45-30	ok	6	0		
						30-15	ok	8	0		
						15-0	ok	4	0	13.27	38.72
	13.03.13	17219-2	42°44,98	14°47,94	198	190-160	ok	0	1		
	15:00					160-120	ok	0	0		
						120-80	ok	1	0		
						80-40	ok	0	1		
						40-0	ok	0	0		
	13.03.13	17219-3	42°44,98	14°47,94	198	125-100	ok	0	0	13.44	38.79
	15:30					100-75	ok	0	1		
						75-50	ok	1	1		
						50-25	ok	1	1		
						25-0	ok	0	0	13.76	38.72
Discovery Basin											
	17.03.13	17227-2	35°16,49	21°38,08	3275	500-400	ok	0	0		
	18:00					400-300	ok	3	0		
						300-200	ok	1	0		
						200-100	ok	1	3	15.83	39.05
						100-0	ok	1	2	15.83	39.05
	18.03.13	17231-1	35°20,00	21°36,92	3340	500-400	ok	0	1		
	16:30					400-300	ok	0	1		
						300-200	ok	0	0		
						200-100	ok	2	0		
						100-0	ok	2	0		
Ionian Sea											
	19.03.13	17232-1	37°31,14	19°44,3	3336	500-400	ok	0	0		
	09:40					400-300	ok	0	0		
						300-200	ok	0	0		
						200-100	ok	0	0	14.97	38.91
						100-0	ok	1	2	14.96	38.91
	19.03.13	127233-2	38°9,56	19°11,27	3159	500-400	ok	0	0		
	16:30					400-300	ok	0	0		
						300-200	ok	0	0		
						200-100	ok	0	1		
						100-0	ok	1	0		
Golf of Taranto											
	20.03.13	17234-1	40°0,0	17°34,97	891	500-400	ok	5	0		
	08:45					400-300	ok	1	1		
						300-200	ok	5	3		
						200-100	ok	6	1	14.28	38.87
						100-0	ok	6	0	14.36	38.88
	21.3.13.	17244-1	39°38,02	17°47,45	1235	500-400	ok	0	0		
	12:30					400-300	ok	1	0		
						300-200	ok	3	0		
						200-100	ok	0	0		
						100-0	ok	1	0		
	21.03.13	17245-1	39°11,93	17°33,87	1025	500-400	ok	3	1		
	15:35					400-300	ok	1	0		
						300-200	ok	0	0		
						200-100	ok	0	0		
						100-0	ok	0	0		

Table 3: Multinet deployment

Reasons could be:
a. Insufficient food availability
Winter conditions in 2013 continued in the Mediterranean region even during March. It appears to be too early for a spring bloom of phytoplankton. See fluorescence data as a measure for the amount of chlorophyll in this report. So the food availability for foraminifers in contrast to April 2010 might be unsatisfactory this month.

b. Water conditions
During the whole journey we had windspeeds of 5-8 Beaufort. As a consequence the water column was neither calm nor stratified.
Water temperature was varying between 11,5 and 15,8°C in the upper 125 m, salinity between 38,4 and 39,1 %o.

c. Reproduction
A lot of foraminifer species are reproducing with the full moon as a timer. Last fullmoon was on Feb 25th. The next fullmoon, when the environmental conditions (nutrition and temperature) for reproduction might be better, is on March 27th, too late for this journey.

d. Mesh size
The nets that were used had a mesh size of 200 micrometer. This size is too large for smaller foraminifer species like G. glutinata for example and also for the younger specimen of larger foraminifer species. But nevertheless, it should have been possible to catch most foraminifer species in adult and terminal life stages. These were the main target groups. For future deployments nets with a mesh size 100 micrometer will be better suited.

4.5. Plankton sampling for analysis of the coccolithophorid community

(K.-H. Baumann)

Coccolithophores are marine unicellular algae (Prymnesiophyceae) and the predominant group of calcifying marine phytoplankton. Although much information is available on the oceanic scale distribution of coccolithophores, the environmental parameters that control the distribution of them are still poorly understood. This reflects, in part, a shortage of suitable studies on natural populations. The basic understanding of modern ecological affinities of the species is, however, essential for paleoecological studies using coccolith assemblages as proxies in the geological record.
Therefore, water samples of the uppermost water column from xy stations were collected during the cruise Pos 448 to study the species composition and the depth distribution of the coccolithophorid communities in the western Adriatic Sea and central Ionian Sea. Water samples were taken from NISKIN-bottles of the rosette (see chapter 4.2) at 20 stations from water depths between 5 and 175 m (Table x). Between 2.5 l and 8.5 l of water was filtered immediately onboard through glass fibre filters (50 mm diameter, 0.5 µm pore size) by means of a vacuum pump. Without washing, rinsing or chemical conservation the filters were dried at 30°C for at least 24h and then kept permanently dry wit in transparent film. Studies of the distribution and composition of the coccolithophorid communities will be carried out on the filtered material using a Zeiss DSM 940A Scanning Electron Microscope at the University of Bremen.

Table 4: Water samples from Rosette casts for analyses of coccolithophorid depth distribution.

GeoB No.	Sample No.	Date	Location Latitude (N)	Longitude (W")	Water Depth [m]	Sample Depths [m]	Temp. [°C]	Salinity	Filtered Volume [l]
17201-1	I-1	8.3.13	41° 30,30'	16° 24,05'		10	12,80	38,320	4,5
	I-2					20	13,65	38,732	5,0
	I-3					30	13,59	38,770	5,0
17202-1	II-1	8.3.13	41° 39,98'	16° 14,98'	16,1	10	10,58	37,045	4,5
17203-1	III-1	9.3.13	42° 01,30'	15° 10,31'	29,4	5	11,36	37,760	3,0
	III-2					10	11,88	38,178	2,5
	III-3					20	12,15	38,302	3,5
17204-2	IV-1	9.3.13	42° 18,99'	15° 14,99'	127,0	10	12,01	38,466	4,5
	IV-2					20	11,96	38,466	5,0
	IV-3					40	11,88	38,556	5,0
	IV-4					80	11,54	38,711	5,0
	IV-5					100	11,48	38,715	5,0
17205-1	V-1	9.3.13	42° 14,99'	14° 48,32'	60,2	5	13,34	38,625	5,0
	V-2					10	13,32	38,720	5,0
	V-3					30	13,20	38,722	5,0
	V-4					50	13,20	38,722	5,0
17206-1	VI-1	10.3.13	43° 21,01'	14° 05,98'	61,0	5	12,35	38,801	5,0
	VI-2					10	12,56	38,804	5,0
	VI-3					20	12,29	38,829	5,0
	VI-4					40	11,94	38,827	4,5
17209-1	VII-1	10.3.13	43° 22,29'	14° 21,96'	85,6	10	13,27	38,716	5,0
	VII-2					30	12,95	38,752	5,0
	VII-3					50	12,52	38,821	5,0
	VII-4					70	12,17	38,850	5,0
17210-1	VIII-1	11.3.13	43° 54,97'	13° 17,99'	39,7	10	11,12	38,320	5,0
	VIII-2					20	10,43	38,341	4,5
	VIII-3					30	10,47	38,342	4,5
17214-1	IX-1	11.3.13	43° 46,00'	13° 47,97'	68,1	10	12,74	38,754	5,0
	IX-2					30	12,42	38,796	5,0
	IX-3					50	12,28	38,808	5,0
17216-1	X-1	12.3.13	44° 46,97'	12° 36,32'	24,2	10	9,63	38,344	5,0
17217-1	X-2	12.3.13	44° 45,06'	12° 45,00'	31,0	10	9,60	38,454	4,5
17218-1	X-3	12.3.13	44° 43,99'	12° 53,50'	36,0	15	10,38	38,282	5,0
17219-1	XI-1	13.3.13	42° 44,99'	14° 47,96'	197,5	10	13,76	38,719	5,0
	XI-2					20	13,69	38,729	5,0
	XI-3					40	13,46	38,764	5,0
	XI-4					60	13,45	38,764	5,0
	XI-5					80	13,44	38,766	5,0
	XI-6					100	13,47	38,780	5,0
	XI-7					125	13,44	38,791	5,0
17220-1	XII-1	13.3.13	42° 35,98'	14° 15,36'	41,4	10	12,82	38,662	5,0
	XII-2					30	11,45	38,628	4,5
17221-1	XIII-0	13.3.13	42° 27,12'	14° 22,99'	27,0	15	12,62	38,751	4,5
17222-1	XIII-1	14.3.13	42° 27,27'	14° 28,01'	67,4	10	11,42	38,128	5,0
	XIII-2					30	12,45	38,784	5,0
	XIII-3					50	12,01	38,806	4,0
17230-1	XIV-1	18.3.13	35° 16,46'	21° 41,46'	3527	10	15,91	39,067	7,5
	XIV-2					20	15,89	39,066	7,0
	XIV-3					40	15,89	39,064	8,0
	XIV-4					60	15,89	39,065	5,0
	XIV-5					80	15,89	39,064	6,0

	XIV-6					100	15,89	39,064	5,0
	XIV-7					125	15,90	39,066	8,0
	XIV-8					150	15,90	39,065	7,5
17232-2	XV-0	19.3.13	37° 31,14'	19° 44,36'	3384	5	15,03	38,907	7,5
	XV-1					10	14,98	38,907	8,0
	XV-2					20	14,98	38,907	7,5
	XV-3					40	14,96	38,908	7,0
	XV-4					60	14,96	38,907	8,5
	XV-5					80	14,97	38,908	7,5
	XV-6					100	14,97	38,908	8,0
	XV-7					125	14,97	38,907	7,5
	XV-8					150	14,97	38,906	7,0
17233-1	XVI-0	19.3.13	38° 09,57'	19° 11,26'	3168	5	14,77	38,884	5,0
	XVI-1					10	14,73	38,886	6,0
	XVI-2					20	14,72	38,886	5,5
	XVI-3					40	14,71	38,886	6,0
	XVI-4					60	14,71	38,889	6,5
	XVI-5					80	14,71	38,899	6,5
	XVI-6					100	14,72	38,903	7,0
	XVI-7					125	14,73	38,913	8,5
	XVI-8					150	14,74	38,919	7,0
	XVI-9					175	14,68	38,921	7,0
17234-2	XVII-0	20.3.13	40° 00,00'	17° 35,01'	910	5	14,48	38,879	7,0
	XVII-1					10	14,40	38,878	7,0
	XVII-2					20	14,39	38,877	7,0
	XVII-3					40	14,36	38,876	6,0
	XVII-4					60	14,35	38,877	6,5
	XVII-5					80	14,35	38,876	6,2
	XVII-6					100	14,34	38,875	6,2
	XVII-7					125	14,32	38,872	7,3
	XVII-8					150	14,28	38,865	7,0
17238-1	XVIII-0	20.3.13	40° 16,01'	17° 21,48'	324	5	14,30	38,806	7,5
	XVIII-1					10	14,21	38,783	7,0
	XVIII-2					20	13,93	38,738	6,5
	XVIII-3					40	13,91	38,756	6,5
	XVIII-4					60	13,97	38,784	7,5
	XVIII-5					80	13,99	38,787	6,5
	XVIII-6					100	13,99	38,787	7,5
	XVIII-7					125	13,99	38,788	7,0
	XVIII-8					150	14,00	38,789	7,0

4.6 In-Situ pump deployment

To determine the organic-geochemical and palynological characteristics of the sediment load of the individual Italian rivers the suspension load of the upper water turbidity maximum has been sampled on 18 sample locations (Tab. 5).

Station	Latitude	Longitude	Depth [m]	Pumped Volumen [l]	Time pumped [min]	max. pumping volumen [l/min]	Filternumber	Comment
GeoB17201-2	41°30.300 N	16°23.992 E	35	---	---	---	1	Pump did not work
GeoB17201-2			18	---	---	---	2	Pump did not work
GeoB17202-2	41°39.959 N	16°15.013 E	13	299.02	60	7.04	3	
GeoB17202-2			13	299.35	60	7.06	4	
GeoB17203-2	42°01.29 N	15°10.31 E	20	299.02	60	7.04	5	
GeoB17203-2			7	299.02	60	7.08	6	
GeoB17206-2	43°21.011 N	14°05.955 E	40	299.02	60	7.04	7	
GeoB17206-2			21	299.02	60	7.06	8	
GeoB17207-2	43°21.973 N	13°48.003 E	6	299.01	60	7.08	9	
GeoB17207-3			6	299.02	60	7.04	10	
GeoB17210-2	43°54.991 N	13.18.019 E	28	299.02	60	7.06	11	
GeoB17210-2			24	299.02	60	7.06	12	
GeoB17211-2	43°49.261 N	13°12.063 E	5	299.00	60	7.04	13	
GeoB17211-3			5	76.03	---	7.04	14	minimum flow reached after 783s.
GeoB17212-2	43°50.062 N	13°10.591 E	5	299.00	60	7.06	15	
GeoB17215-2	44°51.316 N	12°33.986 E	13	299.00	60	7.06	16	
GeoB17215-2			5	23.32	---	7.01	17	sudden pressure release
GeoB17216-2	44°46.961 N	12°36.306 E	6	298.99	60	7.06	18	
GeoB17216-2			8	23.38	---	6.90	19	sudden flow obstruction
GeoB17218-2	44°43.996 N	12°53.482 E	13	299.00	60	7.08	20	
GeoB17218-2			7	299.19	60	4.03	21	new pump is used. Just pumps 4 l
GeoB17220-2	42°36.004 N	14°15.306 E	23	299.00	60	7.06	22	
GeoB17220-2			18	---	60	---	23	no data record
GeoB17221-2	42°27.124 N	14°23.024 E	8	299.01	60	7.08	24	
GeoB17221-3			8	299.19	60	4.02	25	
GeoB17222-2	42°27.261 N	14°28.000 E	15	299.01	60	7.06	26	
GeoB17222-2			10	223.88	60	4.04	27	
GeoB17225-2	---	---	25	---	60	---	28	canceled due to strong wind
GeoB17225-2			30	---	60	---	29	canceled due to strong wind
GeoB17238-2	40°16.017 N	17°21.488 E	30	299.02	60	7.04	30	Jochen test
GeoB17238-2			22	299.02	60	7.08	31	
GeoB17238-2			17	224.73	60	4.05	32	
GeoB17239-2	40°12.498 N	17°31.498 E	50	229.19	60	4.04	33	Ginger test
GeoB17239-2			40	229.19	60	4.03	34	
GeoB17239-2			20	299.02	60	7.04	35	
GeoB17240-2	40°8.007 N	17°40.791 E	25	299.02	60	7.08	36	
GeoB17240-2			30	229.19	60	4.03	37	
GeoB17241-2	40°0.018 N	17°49.973 E	30	299.02	60	7.06	38	
GeoB17241-2			190	229.19	60	4.03	39	
GeoB17242-2	39°50.041 N	17°59.007 E	30	299.02	60	7.06	40	
GeoB17242-2			35	229.19	60	4.03	41	
GeoB17243-2	39°45.549 N	17°53.753 E	20	299.02	60	7.06	42	
GeoB17243-2			150	229.19	60	4.03	43	

Table 5. In-Situ pump deployments.

5. Sediment sampling: Multicore

5.1. Multicore sampling

Poseidon cruise sedimentology concentrated on three regions. The italian Adriatic Shelf, The shelf of the northeastern Gulf of Taranto and the anoxic and oxic sediments around the Discovery and Urania Basins West of Crete, Greece.
Unless stated otherwise all sediments collected during the cruise consist of clays which are anoxic at depth and have a top oxidised and bioturbated layer varying in thickness between 0 and 10 cm. From all stations two 9.5 cm diameter MUCs have been frozen except for the MUCs from the Discovery basin which due to their high salt content fail so freeze at -32°C and the last station where only one MUC of 6 cm diameter could be recovered.

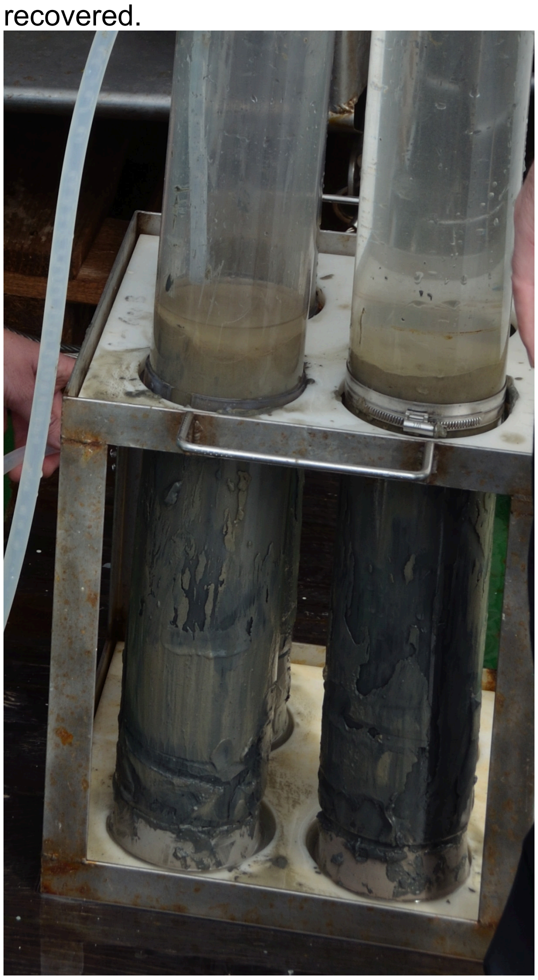


Fig. 10. Multicore 17203-3 from the Gargano Bay. A typical example of a multicore from the Adriatic shelf. Clays with a 1 to 10 cm oxididised layer on top of grey to black anoxic sediments.

The Italian Adriatic Shelf

For interpreting the sedimentary archives in the Gulf of Taranto it is essential to understand the influence of the Adriatic Coastal Current (ACC) on this region. The ACC has two major contributing components: the Po river outflow (Padane contribution) and the Apennine rivers (Apennine contribution). To assess these components is essential to obtain a calibration dataset and sedimentary archives representing the environmental N-S and onshore-offshore gradients in the Italian Adriatic. Whereas in a previous cruise we obtained material from the > 6 miles zone, this cruise concentrates on the 3-6 miles zone where the core of the ACC as well as the Holocene Adriatic Mudbelt (HAM) are located.

From South to North:

- Bay of Gargano:
  - 17201/3/4 MUC at 47 m water depth.

17201/5 SL was collected at 76 m water depth. Previous palynological work at a MUC showed that the location contains excellent sediments for high resolution environmental reconstruction.

Biferno and Sangro outflows:

17203/3/4 MUC at 33 m water depth and 17224/1 Gravity core at 76 m water depth with a recovery of 380 cm.

Pescara outflow:

17222/3/4 at 73 m water depth. Multicore 1x not released only three small tubes, 2nd time full and station 17223/1/2 Multicore 1x complete 2nd run not released, two narrow tubes

Fiume outflow:

17206/3/4/5 at 21 m waterdepth

Potenza outflow:

Capturing 17207/4/5/6 at 12 m depth. Silt to fine sand shell fragments and whole shells.

Foglia outflow

17210/3/4 44 m water depth. Together with the next station capturing the Foglia outflow.

17211/4/5/6 at 14 m. Silt to fine sand many shells, tube worms and infaunal shrimp.

Po river outflow:

All three stations had deep bioturbation and a thick oxidised top layer.

17215/4 Clay with infaunal echinoderm, burrowing worms and green spoonworm *Bonellia viridis*

17216/ 3/4 Clay and burrowing worms

17217/2 Clay with burrowing U-worms up to 30 cm in length

Anoxic Discovery and Urania basins and surroundings, Greece.

The main goal here is assess the influence of the presence of oxygen on organic matter degradation in an open oceanic setting. To achieve this collected anoxic sediments from the Discovery Basin and oxic sediments just outside this basin.

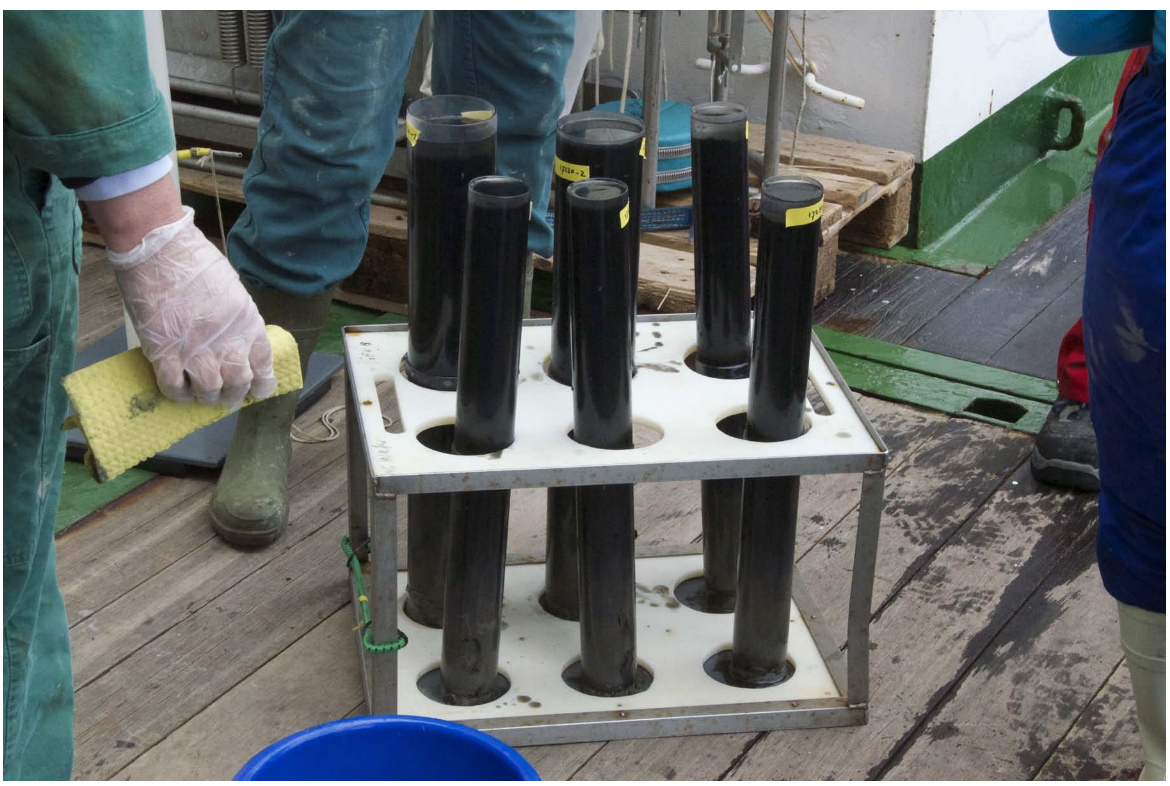


Fig. 11. The anoxic sediments recovered with the multicorer from the Discovery basin. Note the partly oxidised clay in the lower 1/4 of the cores.

Fig 12. Multicore with the partly oxidised S1 sapropel in the lower 1/3 of the core, recovered from the shallower oxic sediments just west of the Discovery Basin.

Discovery Basin

At station17226/1/2/3, the gravity corer was deployed twice alternated with the multicorer. The MUC did not release. A second MUC deployment (17230/2) recovered tubes almost completely full with black unconsolidated mud in a strong salt solution which doesn't freeze at -32°C (Fig. 2). Several bags of the unoxidised black toplayer of unconsolidated sediment have been collected for later experiments on organic matter degradation.

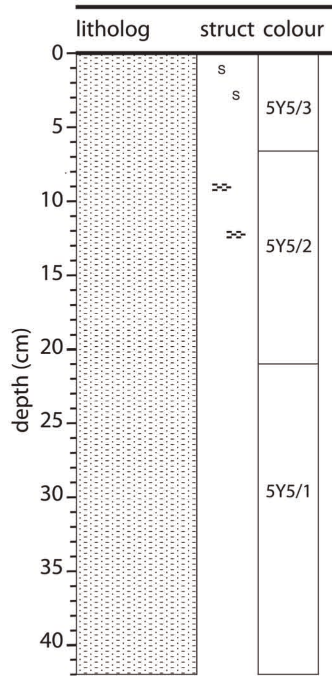
Oxic sediments near the Discovery Basin

Gravity core 17227/1 was taken just west of the Discovery Basin but lost during taking out of the water onboard due to breaking of the cable close to the winch. Multicore 17229/2 (Fig 3) reaches the unoxidised S1 sapropel. Several bags of oxidised sediment deposited during the last 6 ka have been collected for later experiments on organic matter degradation.

Urania basin
Samples from the Urania Basin mud volcano (Station 17228/1/2/3) were obtained through deployment of Niskin bottles which were let down in the hot and strongly reducing environment and closed subsequently. The first deployment provided clear water with reduced sulphur species. The second deployment provided a bottle with black unconsolidated mud. The third deployment the bottle did not release but on the weight directly underneath a large clump of sediment remained and which has been collected.

GeoB 17201-3,4

Date: 08.03.2013 Pos: 41°30.290′ N, 16°24.007′ E
water depth: 46 m Core length: 42 cm



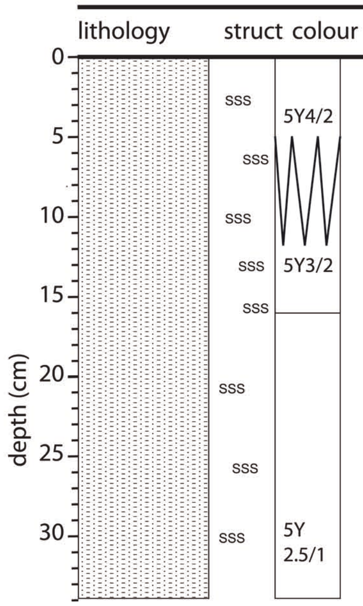
Throughout the core fine silty-clay with black particles

Structure homogeneous, with some black layers

Colour olive to olive-gray

GeoB 17203-3

Date: 09.03.2013 Pos: 42°01.290′ N, 15°10.298′ E
water depth: 37 m Core length: 34 cm



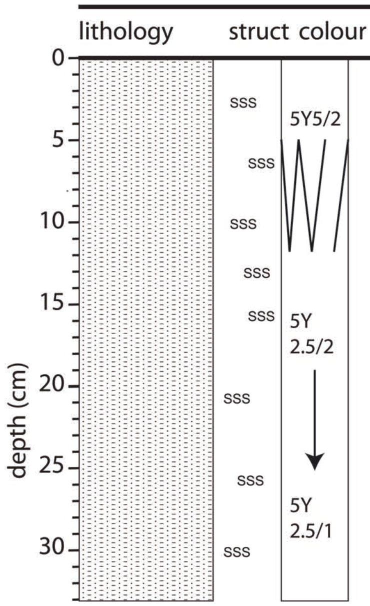
Throughout the core fine silty-clay with black particles. Redox boundary between 5 and 13 cm

Structure: strongly bioturbated throughout core

Colour olive to olive-gray - dark olive-gray - black

GeoB 17203-4

Date: 09.03.2013 Pos: 42°01.287′ N, 15°10.294′ E
water depth: 33 m Core length: 33 cm



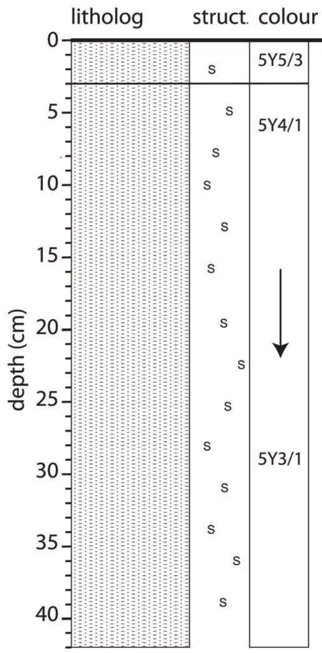
Throughout the core fine silty-clay with black particles. Redox boundary between 5 and 13 cm

Structure: strongly bioturbated throughout core, burrows 10 cm length

Colour olive to olive-gray - dark olive-gray gradual to black

GeoB 17206-4

Date: 10.03.2013 Pos: 43°21.004′ N, 14°05.966′ E
water depth: 66 m Core length: 42 cm



comments

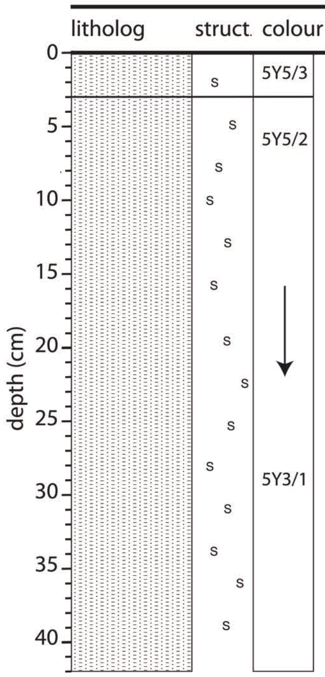
Throughout the core fine silty-clay with black particles. Redox boundary at 3 cm

Structure: slightly bioturbated throughout core, burrows 2 cm length

Colour olive to very dark gray

GeoB 17206-5

Date: 10.03.2013 Pos: 43°20.092′ N, 14°05.985′ E
water depth: 65 m Core length: 42 cm



comments

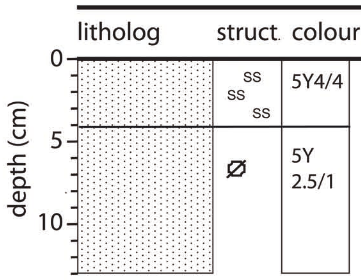
Throughout the core fine silty-clay with black particles. Redox boundary at 2 cm

Structure: slightly bioturbated throughout core, burrows 2 cm length

Colour olive to very dark gray

GeoB 17207-6

Date: 10.03.2013 Pos: 43°21.997′ N, 13°47.997′ E
water depth: 12 m Core length: 13 cm



comments

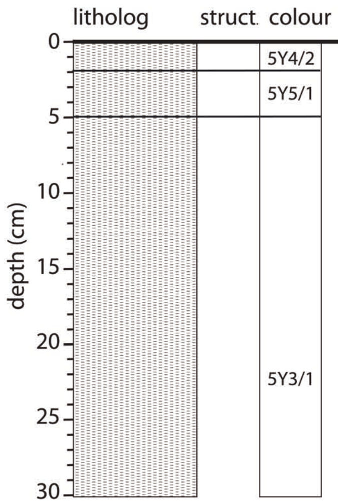
Throughout the core silt to fine sand with black particles. Redox boundary at 4 cm

Structure: slightly bioturbated throughout core, burrows 2 cm length. Several shell fragments

Colour olive to black

GeoB 17210-3

Date: 11.03.2013 Pos: 43°54.007′ N, 13°18.013′ E
water depth: 49 m Core length: 30 cm



comments

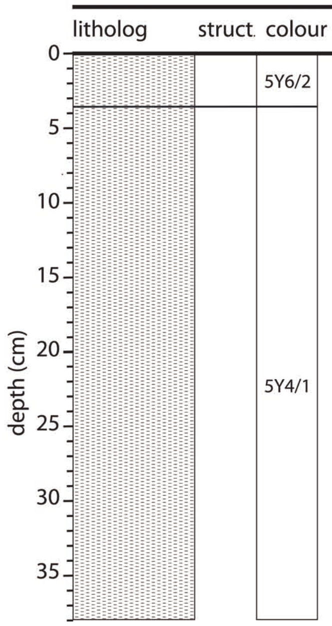
Throughout the core clay with black particles.
Redox boundary at 2 cm depth.

Structure homogeneous, no visible bioturbation

Colour light gray to very-dark-gray

GeoB 17210-4

Date: 11.03.2013 Pos: 43°54.007′ N, 13°18.036′ E
water depth: 49 m Core length: 38 cm



comments

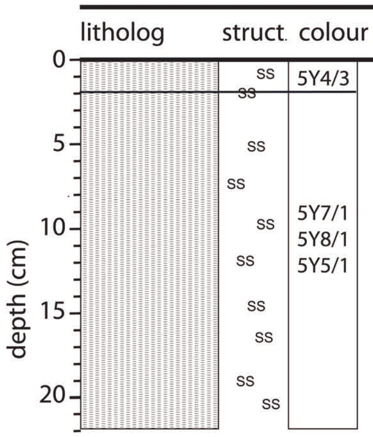
Throughout the core clay with black particles.
Redox boundary at 3.5 cm depth.

Structure homogeneous, slightly bioturbated to 1 cm burros

Colour light olive-gray to dark-gray

GeoB 17211-6

Date: 11.03.2013 Pos: 43°49.297′ N, 13°12.002′ E
water depth: 14 m Core length: 22 cm



comments

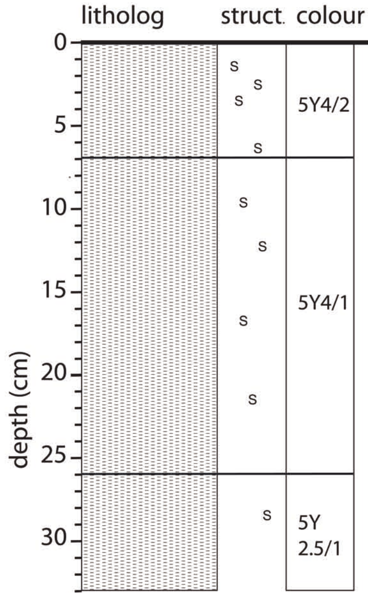
Throughout the core silty to fine sand.
Redox boundary at 2 cm depth.

Structure strongly bioturbation

Colour olive to gray/light gray

GeoB 17215-3

Date: 12.03.2013 Pos: 44°51.273′ N, 12°34.051′ E
water depth: 22 m Core length: 33 cm



comments

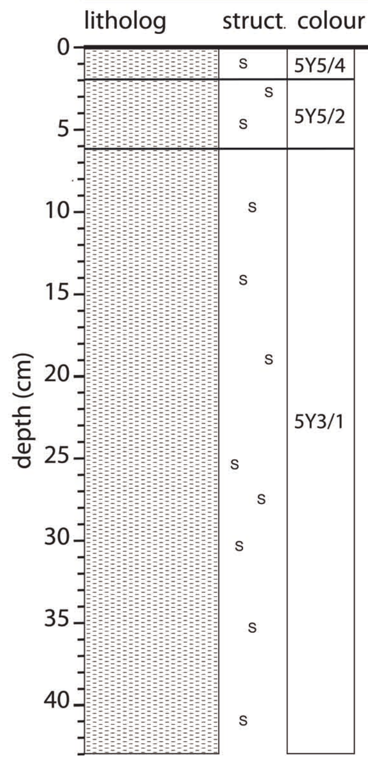
Throughout the core clay with black particles.
Redox boundary at 7 cm

Structure homogeneous, bioturbation with burros up to 4 cm

Colour olive-gray to black

GeoB 17216-3

Date: 12.03.2013 Pos: 44°46967′ N, 12°36.300′ E
water depth: 27 m Core length: 43 cm



comments

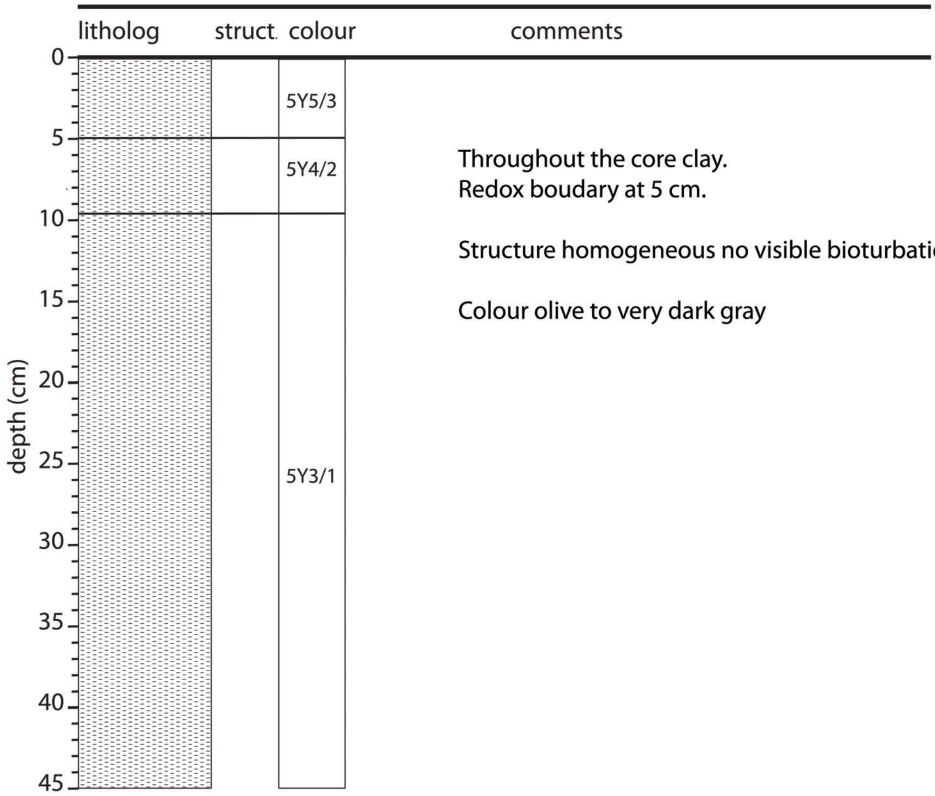
Throughout the core claywith black particles.
Redox boundary at 2 cm

Structure homogeneous, bioturbation with burrows up to 5 cm

Colour olive to dark-gray

GeoB 17217-2

Date: 12.03.2013 Pos: 44°45.049′ N, 12°44.993′ E
water depth: 33 m Core length: 45 cm



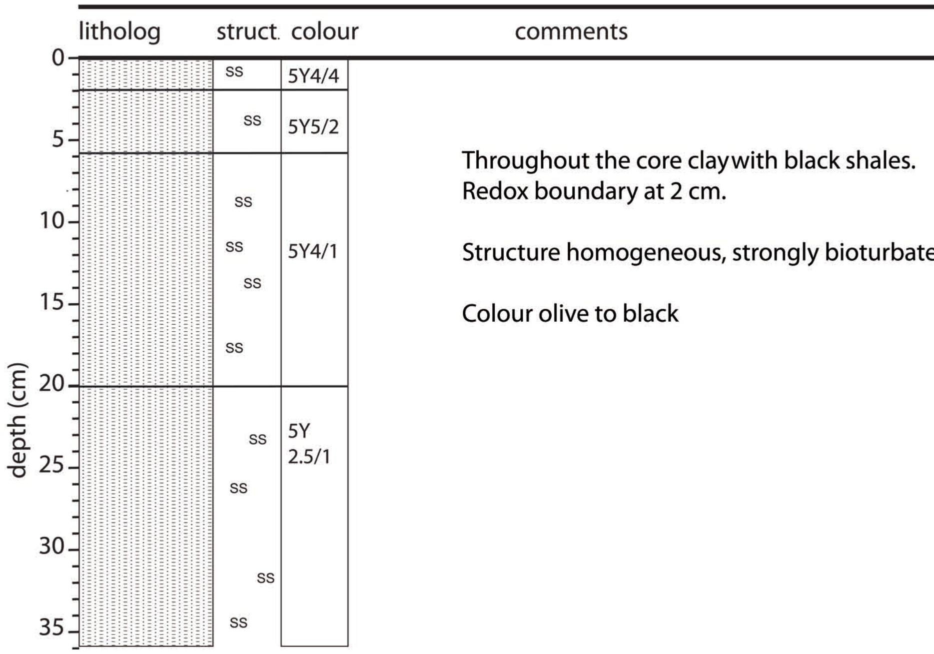
Throughout the core clay.
Redox boudary at 5 cm.

Structure homogeneous no visible bioturbation

Colour olive to very dark gray

GeoB 17222-3

Date: 14.03.2013 Pos: 42°27.992′ N, 14°27.992′ E
water depth: 73 m Core length: 36 cm



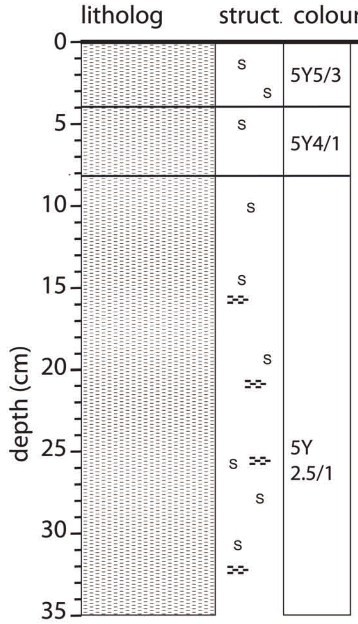
Throughout the core claywith black shales.
Redox boundary at 2 cm.

Structure homogeneous, strongly bioturbated

Colour olive to black

GeoB 17223-1

Date: 14.03.2013 Pos: 42°27.139' N, 14°23.039' E
water depth: 27 m Core length: 36cm



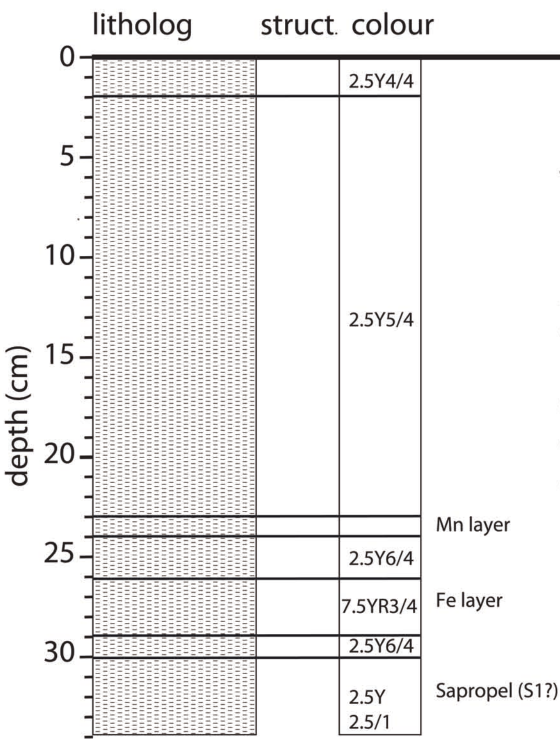
Throughout the core clay with black particles.
Below 15 cm black isolated laminae.
Redox boundary at 4 cm

Structure homogeneous, bioturbated

Colour olive to black

GeoB 17229-2

Date: 18.03.2013 Pos: 35°17.010' N, 21°37.980' E
water depth: 3544 m Core length: 34 cm



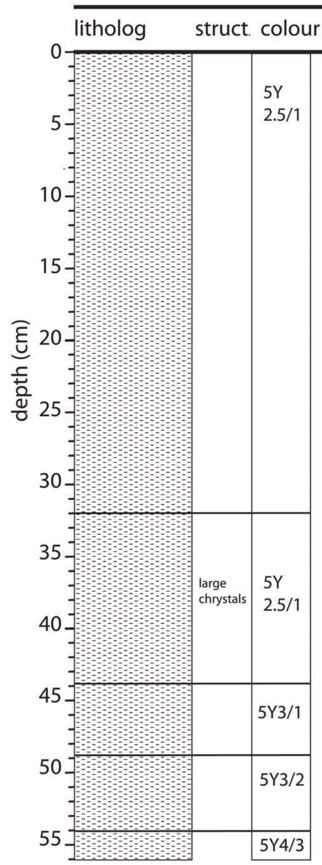
Throughout the core fine clay.
Redox boundary 2 cm.

Structure homogeneous, bioturbation
only in upper 2 cm

Colour olive-brown to light olive brown with
gray and reddish layers on top of
dark layer

GeoB 17230-2

Date: 18.03.2013 Pos: 35°16.935′ N, 21°41.516′ E
water depth: 3847 m Core length: 56 cm



comments

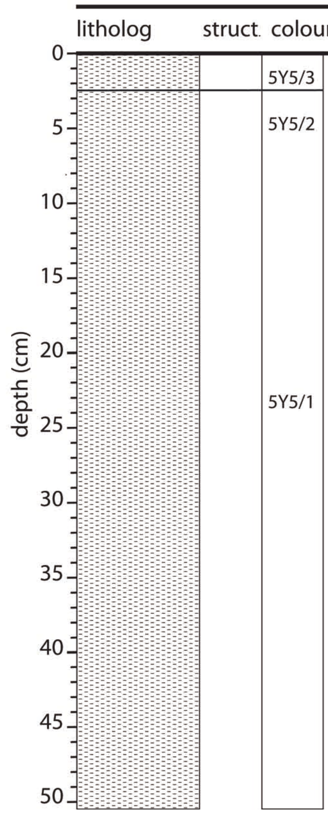
Throughout the core clay

Structure homogeneous, between 32 - 44 cm
large globules/christals probably $MgCaCO_3$

Colour black to olive

GeoB 17235-1

Date: 20.03.2013 Pos: 40°08.005′ N, 17°40.970′ E
water depth: 188 m Core length: 55.5 cm

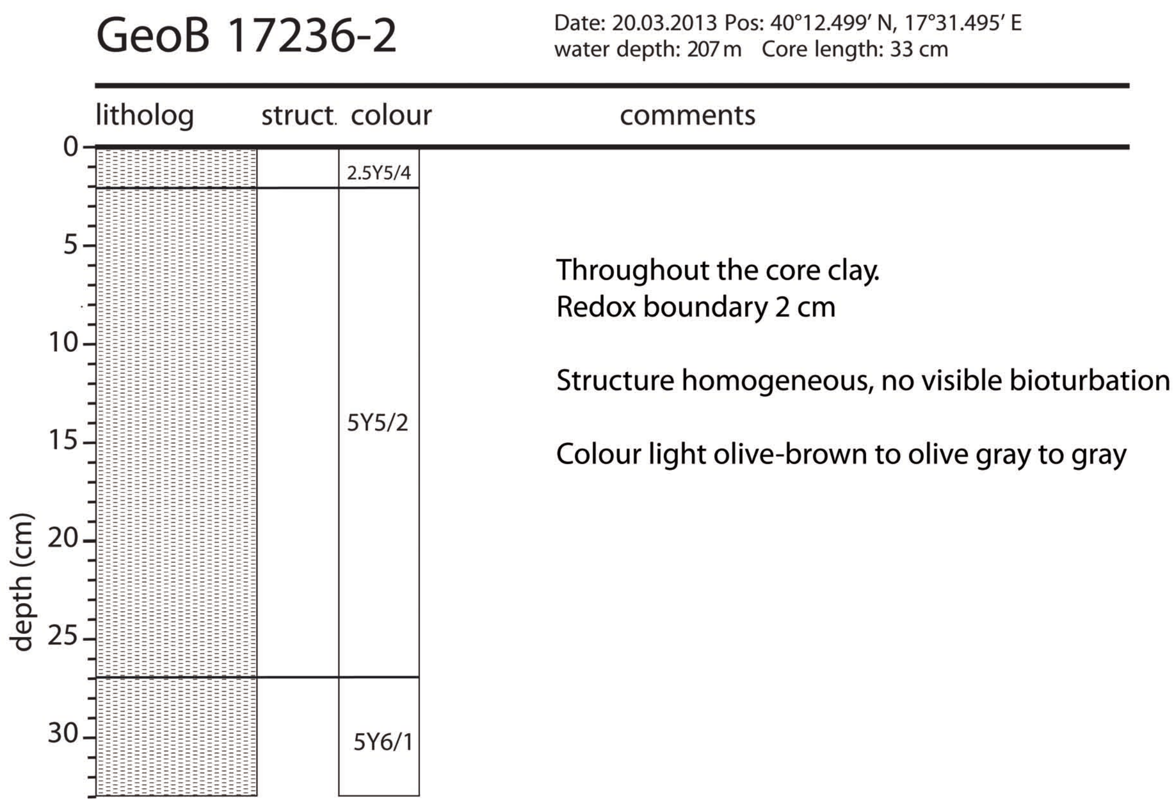


comments

Throughout the core clay. Redeox boudary at 2.5 cm.

Structure homogeneous, no visible bioturbation
only on one subcore a small burrow of 2 cm observed

Colour olive to gray



Gulf of Taranto

Here sediments have been collected at the east side of the Gulf North of 40°N to extent the area covered by our dataset and to capture the distal part of the mixing zone between the lower saline waters derived from the West Adriatic Current and the Ionian Sea surface and intermediate waters.

17235/1/2 MUC, SW of Porto Cesareo. Very soft pure clays with 2 cm oxidised top layer (Fig. 4).
17236/1 MUC, W of Porto Cesareo. Stiff clay with heavily oxidised and bioturbated top two cm.
17237/1 MUC, the northernmost station in the Gulf of Taranto with sediments a mixture of foraminifera sand and fine clay. Unfortunately the MUC failed to close repeatedly so that after three attempts only one core with 6 cm diameter could be recovered.

Fig. 13. Top section of a multicore recovered in the Gulf of Taranto showing the very unconsolidated clays just SW of Porto Cesareo. Note the different colour of the oxidised 2 cm of the core.

5.2. The distribution of benthic foraminifera in the western Adriatic Sea and the Gulf of Taranto
(Ole Valk, Marc Theodor)

5.2.1 Introduction

The distribution of benthic foraminifera is highly correlated with organic matter supply as well as the oxic conditions of the bottom water and within the uppermost centimetre of the sediment. These factors lead to characteristic microhabitat assemblages well known from outer shelf to deep sea environments (e.g. Jorissen et al., 1995).
In contrast to this, environments of the shallow shelf are also influenced by grain size, salinity or variable nutrient supply, due to river input. This is visible in a higher variety of benthic foraminiferal assemblages.
The western Adriatic Sea offers good research conditions, due to its oxygenated water masses, high input of fine grained sediment as well as organic matter caused by the Po river and numerous smaller rivers of the Apennine Mountains.

5.2.2. Methods and Samples

During the research cruise P448 CAPRICCIO a multicorer (MUC) was used to sample undisturbed samples of the upper centimetres of the sediment as well as the bottom water. The MUC attains a maximum of 10 tubes, which are 60 cm long. Six of these have a diameter of 9.5 cm, the remaining four of 6 cm. The multicorer was used at 11 stations in the Adriatic Sea, two at the Urania/ Discovery Basin, west of Crete, and two in the Gulf of Taranto. Due to the shallow water conditions in the Adriatic Sea and in the Gulf of Taranto the MUC was used up to three times at each station. To investigate the depth-related microhabitat of benthic foraminifera, the cores were sliced in 0.5 cm intervals for the first centimetre and 1 cm intervals down to 10 cm if possible. After this procedure all samples were soaked with ethanol mixed with Rose Bengal to stain living foraminifera for an easier assessment.

For geochemical and clay-mineral investigations at the Universities of Hamburg and Leipzig the first centimetre of the sediment surface was collected and frozen at -20°C (tab. 1).

To gain a first overview of the foraminiferal assemblages, unstained samples below the sediment surface at 10-12 cm depth were investigated during the cruise P448 CAPRICCIO (tab. 2). The samples were washed over a >63 µm sieve and about 170 to 1500 individuals were counted and determined to identify their microhabitat preferences. During this procedure planktic foraminifera were also counted for the P/B-ratio, which shows the percentage of planktic foraminifera, due to the total number of foraminifera.

tab. 1: List of P448 Multicorer stations used forsampling of benthic foraminifera and clay minerals

Station	Date	Latitude [°N]	Longitude [°E]	Recovery [cm]	Remarks	Benthic foram HH	Stable isotopes HH [cm]	Clay min. U. Leipzig [cm]
17201-3	08.03.13	41°30.30'	16°24.05'	38	bioturbated	0-10*		
17201-4	08.03.13	41°30.30'	16°24.05'	38	bioturbated		0-1°	0-1°
17203-3	09.03.13	42°01.28'	15°10.29'	33	strongly bioturbated	0-10*		
17203-4	09.03.13	42°01.28'	15°10.29'	33	strongly bioturbated		0-1°	0-1°
17206-3	10.03.13	43°21.02'	14°05.97'	0	no samples			
17206-4	10.03.13	43°21.00'	14°05.97'	39	bioturbated	0-10*		
17206-5	10.03.13	43°21.00'	14°05.97'	39	bioturbated		0-1°	0-1°
17207-4	10.03.13	43°21.99'	13°48.01'	0	strongly disturbed, no samples			
17207-5	10.03.13	43°21.99'	13°47.99'	18	bioturbated		0-1°°	
17207-6	10.03.13	43°21.99'	13°47.99'	11	bioturbated	0-8*		0-1°
17210-3	11.03.13	43°55.00'	13°18.01'	36	bioturbated	0-10*		
17210-4	11.03.13	43°55.00'	13°18.01'	36	bioturbated		0-1°	0-1°°
17211-4	11.03.13	43°49.29'	13°12.03'	0	no samples			
17211-5	11.03.13	43°49.29'	13°12.03'	18	four cores, bioturbated		0-1°°	0-1°°
17211-6	11.03.13	43°49.29'	13°12.03'	18	bioturbated	0-10*		
17215-3	12.03.13	44°51.27'	12°34.06'	37	strongly bioturbated	0-10*		
17216-3	12.03.13	44°46.96'	12°36.30'	38	strongly bioturbated	0-10*		
17216-4	12.03.13	44°46.96'	12°36.30'	38	strongly bioturbated		0-1°	0-1°
17217-2	12.03.13	44°45.04'	12°44.99'	46	strongly bioturbated	0-10*	0-1°°°	0-1°°°
17222-3	14.03.13	42°27.29'	14°27.97'	37	three cores, bioturbated			
17222-4	14.03.13	42°27.29'	14°27.97'	37	bioturbated	0-10*	0-1°°	0-1°°
17223-1	14.03.13	42°27.12'	14°23.02'	33	bioturbated	0-10*	0-1°°	0-1°°
17223-2	14.03.13	42°27.12'	14°23.02'	33	bioturbated			
17226-2	17.03.13	35°16.44'	21°41.51'	0	no samples			
17229-2	18.03.13	35°16.98'	21°37.98'	37		0-37**		
17230-2	18.03.13	35°16.44'	21°41.50'	58		0-58**		
17235-1	20.03.13	40°08.03'	17°40.98'	55		0-10*		
17235-2	20.03.13	40°08.03'	17°41.11'	55			0-1°°	0-1°°
17236-1	20.03.13	40°12.52'	17°31.48'	41		0-10*		
17236-2	20.03.13	40°12.99'	17°31.495'	41			0-1°°	0-1°°
17237-1	20.03.13	40°15.51'	17°21.49	0	no samples			
17237-2	20.03.13	40°15.51'	17°21.49	0	no samples			
17237-3	20.03.13	40°15.51'	17°21.49	0	no samples			

* Tube Ø = 9.5 cm; Intervals: 0-0.5, 0.5-1, 1-2, ... ,9-10 cm + Ethanol +Rose Bengal

** Tube Ø = 9.5 cm; Intervals: 0-0.5, 0.5-1, 1-2, ... ,9-10 cm + Ethanol +Rose Bengal; 10-11,11-12,… until the core bottom

° Tube Ø = 9.5 cm; Intervals: 0-1 cm + surface water, frozen at -20°C

°° Tube Ø = 6.0 cm; Intervals: 0-1 cm + surface water, frozen at -20°C

°°° Tube Ø = 9.5 cm, splitted; Intervals: 0-1 cm + surface water, frozen at -20°C

Table 4. MUC stations used for sampling of benthic foraminifera and clay mineral samples.

5.2.3. Preliminary results

The samples show high standing stocks of benthic foraminifers with moderate diversity. The assemblages mainly exhibit shallow infaunal species like *Nonionella* spp., *Nonion* spp., *Bolivina* spp., *Brizalina* spp. and *Bulimina* spp. These species typically occur in high productivity areas often combined with oxygen depleted conditions in distal marine areas (Sen Gupta and Machain-Castillo, 1993; Ohga and Kitazato, 1997). In the shallow study area (>50 m water depth) the above mentioned conditions are caused by the high organic matter input by the Po river outflow and the

small grain size. As a typical shallow water indicator *Ammonia* spp. points out up to 13.5 % of the absolute abundance (GeoB 17217-2). There is an absence of epifaunal species.
The P/B ratio, which could be used as a water depth indicator (Van der Zwaan et. al, 1990), cannot be applied for the investigated samples, due to the shallow marine environment. A surprisingly fact during identification was the high ratio in the sample 17207 (37.3%), which was the shallowest location (10 m). Most of the specimens were very small, which could lead to a significant shift of the P/B ratio, if only the fraction >125µm would be considered.

5.2.4. Further investigations

For a better understanding of the microhabitat distribution of benthic foraminifera the samples will be investigated at the Geologisch-Paläontologisches Institut (GPI) of the University of Hamburg. The major aim of this study is to map the impact of surface water productivity and organic matter fluxes induced by Po river discharge along the west Adriatic coast and the Gulf of Taranto. Samples from cruises P339 (2006) and P411 (2011) will be used to complete the data set. The recent distribution patterns and stable isotope signatures of benthic foraminifera will serve as reference data set for the evaluation of abrupt productivity changes and fluctuations in Po river discharge during the late Holocene.

5.3. Planktonic and benthic foraminifera distribution in the western Adriatic Sea

(Natalie Iwanczuk)

5.3.1. Introduction

Planktonic foraminifera form a major group of the oceanic plankton and are frequently used as proxy indicators of past oceanic environments. Planktonic foraminifera species are known to thrive in the water column, inhabiting a broad range of water depths related to their specific demands for ontogenetic development. However, the distribution of planktonic foraminifera in shallow-water environments is poorly studied.
As a shallow and narrow basin, the Adriatic Sea is an ideal site to study the planktonic foraminifera being imported from the south by surface water inflow from the fully marine Ionian Sea as a part of the highly saline Eastern Mediterranean. The surface circulation within the Adriatic Sea forms a large cyclonic gyre due to the Coriolis effect: surface waters enter the Adriatic Sea to the East and flow northwards along the coasts of Albania, Montenegro, Croatia, whereas surface waters flow to the South along the Italian Riviera. Towards the northern part of the Adriatic basin, waters get shallower and become more diluted by fresh waters, due to the Po river and from smaller rivers, which mostly stream into the western part of the basin. A first inspection of a surface sediment sample from the western Adriatic Sea at 46 m water depth clearly contained planktonic foraminifera, more than 400 km distant from the Mediterranean. Studies already exist of the planktonic foraminifera distribution in the Adriatic Sea, e.g. Plaschko (2012), but samples of shoal locations of the Adriatic Sea only exist in low numbers, which hinders further analysis. Mainly, absolute abundances of planktonic foraminifera of the same water depth have to be analysed to exceed lateral differences from North to South of the Adriatic Sea.
Benthic foraminifera are the most abundant protists in marine ecosystem (Mojtahid et al., 2010). As they respond quickly to the input of organic material (e.g. Gooday, 1988; Silva et al., 1996; Kitazato et al., 2000) a resulting increase in their abundances and a change of the faunal composition (Linke and Lutze, 1993, Jorissen et al., 1995, Ohga and Kitazato, 1997) or even a modifying of their microhabitat is visual during identification. The shallow environment of the Adriatic Sea offers good research conditions for benthic foraminifera, as it is influenced by the Po river and numerous smaller rivers, which provide a high input of fine grained sediment and also organic matter to the benthic foraminifera community.

5.3.2. Material and Methods

During the research cruise P448 CAPRICCIO sediment surface samples were taken with the multicorer (MUC). The multicorer contains 10 tubes, with a length of 60 cm and an inner diameter of 9,5cm (6 tubes) and 6 cm (4 tubes). The first centimetre was sampled for planktonic foraminifera and further sampling was accomplished to keep living cultures of benthic foraminifera for further analysis at the Department of Geoscience, at the Eberhard-Karls University in Tübingen. Here, ¼ of the first centimetre was taken twice of each study site and stored in flasks at 5°C in the fridge. A water change of sea water every 2-3 days is important to add some oxygen and nutrients to keep the benthic foraminifera alive during the research cruise. The surface sediment (0-1cm) was sampled at each study site and stored at room-temperature.

5.3.3. Further analysis

The sediment surface samples (0-1cm) will be freeze-dried at the Department of Geoscience and for further analysis will be weighted and sieved washed to analyse the planktonic foraminifera distribution. Further analysis, such as dominant planktonic foraminifera species and change in the shell size and shell porosity will be made at the Department for Geoscience, University of Tübingen, to exceed further results.
The Department of Geoscience has a culture laboratory, where the living benthic foraminifera cultures are being stored depending on their quality. The biological aspects of the living benthic foraminifera are being controlled, such as food intake, the speed of locomotion, cyst formation, reproduction, reaction to change of environment and the resulting stress factors, production of stress proteins and others.
Further analyses of these samples are being made, such as wet-sieved, identification with a binocular and geochemical, physiological and molecular biological analysis.

6. Sediment sampling: Gravity core

6.1. Gravity core sampling

6.2. Geochemical analysis in the Discovery Basin and Urania Brine.

6.2.1. Introduction

The Meteor expedition M84/1 DARCSEAS sampled the area of the Discovery Basin and the Urania Brain in 2011. Aim of the DARCLIFE ('*Deep subsurface archaea: carbon cycle, life strategies, and role in sedimentary ecosystems*') project is to investigate the distribution, composition and processes of sub-seafllormicrobial communities with a particular emphasis on benthic archea (Zabel 2011).
During cruise P448 additional samples of the same study area have been obtained. At M84/1 GeoB 15102 was taken from the Discovery Basin and GeoB 1501 from the Urania Brine. During POS 448 gravity cores GeoB 17226 are taken from the Discovery Basin and GeoB 17227 from the area next to the Basin. GeoB 17228 are samples of the fluid mud layer at the Urania Brine.

6.2.2. Inorganic Pore Water Chemistry: Sampling Method

The pore water samples were taken from closed gravity cores through rhizon micro suction samplers. Sampling holes with a diameter of 3.8 mm were drilled through the core liner and pore water was extracted in a depth resolution of approximately 15 cm.

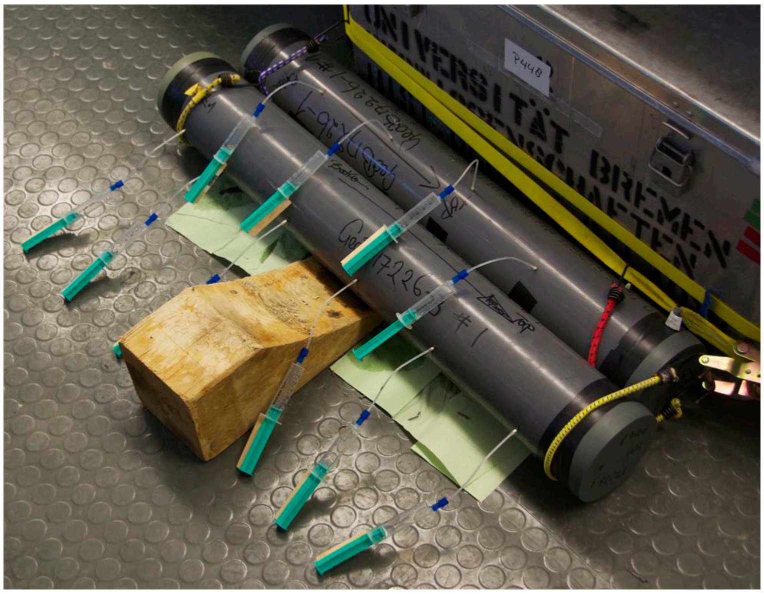


Fig. 14.
Pore water sampling with Rhizon micro suction samplers. Cores GeoB 17226-1 and GeoB 17226-3

GeoB 17226-1 has only a length of 70 cm and was sampled at 10 cm, 25 cm, 40 cm and 55 cm. The sediment of the core was mixed before sampling. GeoB 17226-3 has only a length of 87 cm and was sampled at 10 cm, 25 cm, 40 cm, 55 cm, 70 cm and 80 cm. After that the core was sampled again at 7,5 cm, 32,5 cm, 47,5 cm and 52,7 cm for organic geochemistry analyses. After sampling all samples were directly conserved.

GeoB No.	Date	Time (UTC)	Lat ° N	Long ° E	Water depth (m)	Gear	Sample Type	Sample depth (cm)	Samples Taken for	Remarks
17226-1	17.03.13	09:02	35°16.425'	21°41.490'	3540	Gravity Core	Pore Water	10	M. Zabel	Core length: 70 cm; No on bord analysis, only conservation
17226-1	17.03.13	09:02	35°16.425'	21°41.490'	3540	Gravity Core	Pore Water	25	M. Zabel	Core length: 70 cm; No on bord analysis, only conservation
17226-1	17.03.13	09:02	35°16.425'	21°41.490'	3540	Gravity Core	Pore Water	40	M. Zabel	Core length: 70 cm; No on bord analysis, only conservation
17226-1	17.03.13	09:02	35°16.425'	21°41.490'	3540	Gravity Core	Pore Water	55	M. Zabel	Core length: 70 cm; No on bord analysis, only conservation
17226-3	17.03.13	13:20	35°16.364'	21°41.484'	3549	Gravity Core	Pore Water	10	M. Zabel	Core length: 87 cm; No on bord analysis, only conservation
17226-3	17.03.13	13:20	35°16.364'	21°41.484'	3549	Gravity Core	Pore Water	25	M. Zabel	Core length: 87 cm; No on bord analysis, only conservation
17226-3	17.03.13	13:20	35°16.364'	21°41.484'	3549	Gravity Core	Pore Water	40	M. Zabel	Core length: 87 cm; No on bord analysis, only conservation
17226-3	17.03.13	13:20	35°16.364'	21°41.484'	3549	Gravity Core	Pore Water	55	M. Zabel	Core length: 87 cm; No on bord analysis, only conservation
17226-3	17.03.13	13:20	35°16.364'	21°41.484'	3549	Gravity Core	Pore Water	70	M. Zabel	Core length: 87 cm; No on bord analysis, only conservation
17226-3	17.03.13	13:20	35°16.364'	21°41.484'	3549	Gravity Core	Pore Water	80	M. Zabel	Core length: 87 cm; No on bord analysis, only conservation
17226-3	17.03.13	13:20	35°16.364'	21°41.484'	3549	Gravity Core	Pore Water	17.5	Verena (AG Hinrich)	Core length: 87 cm; No on bord analysis, only conservation
17226-3	17.03.13	13:20	35°16.364'	21°41.484'	3549	Gravity Core	Pore Water	32.5	Verena (AG Hinrich)	Core length: 87 cm; No on bord analysis, only conservation
17226-3	17.03.13	13:20	35°16.364'	21°41.484'	3549	Gravity Core	Pore Water	47.5	Verena (AG Hinrich)	Core length: 87 cm; No on bord analysis, only conservation
17226-3	17.03.13	13:20	35°16.364'	21°41.484'	3549	Gravity Core	Pore Water	62.5	Verena (AG Hinrich)	Core length: 87 cm; No on bord analysis, only conservation

GeoB No.	Date	Time (UTC)	Lat ° N	Long ° E	Water depth (m)	Gear	Sample Type	Bottle depth /Rope length (m)	Samples Taken for	Remarks
17228-2	17.03.13	22:50	35°13.866'	21°28.280'	3500	single Niskin bottle	Sea water	3655	M. Zabel	
17228-3	18.03.13	01:36	35°13.899'	21°28.308'	3501	single Niskin bottle	fluid mud	3720	M. Zabel	
17228-4	18.03.13	04:50	35°13.882'	21°28.311'	3486	single Niskin bottle	sediment	3720	M. Zabel	Niskin bottle has not closed, sediments stuck on the weight

6.2.3. *Inorganic Pore Water Chemistry: Sample Conservation*

The pore water samples were conserved and prepared using different analytic methods. To allow adequate onshore laboratory analyses $S^{\alpha-}$ analysis, 0.5 ml of the collected pore-water sample was diluted with 0.4 ml ZnAc. For onshore DIC, IC and ICP analyses, 2 ml of sample was diluted with 50 µl ZnCl, 50 µl of sample was diluted with 1950 µl MilliQ and to a few ml of the remaining sample one drop was added respectively. All samples are stored and 4°C immediately after recovery and the dilution steps. 1.5 ml of each sample was frozen to allow future PO_4 and NH_4^+ analysis .

6.2.4 Urania Brian: Fluid Mud Layer Sampling

The fluid mud layer of the Urania Brine was sampled by single Niskin bottles and messenger weights. The bottle was attached to the W2 wire one meter over the weight block at the end of the wire. Previous investigations that have been carried out during cruise M84/1 cruise have revealed that suspended mud-volcanic sediments are present at the sampling site at depths between 3625 – 3736 m. Three deployments have been carried out. At the first deployment a sample was recovered at 3655 m. At the second and third deployment samples were recovered at 3720 m depth. When the bottle reached the desire d depth, a metal weight/messenger weigth was dropped down the wire to trigger the closing mechanism of the bottle. The sample recovered from the first deployment consist of brine water with a strong sulphuric smell. 4 Szinti cups of sample were collected and stored at 4°C immediately after recovery.

Sample material recovered during the second deployment consists of fluid mud with a somewhat a less strong sulphuric smell. The sediment was still warm when it arrived at the water surface about 1h after recovery. 10 l of sample were transferred into a plastic container.

During the third deployment, the closing mechanism of the bottle failed to work properly resulting in an empty Niskin Bottle. However, weight-block at the end of the wire was covered by a lot of sulfidic smelling fine homogenous clay. Subsamples of this mud were collected by hand and transferred into a plastic container. Skin contact was avoided by wearing rubbed gloves. The Mud has the same smell as the fluid mud and was warm as well when it arrived on deck.

Fig. 15.
GeoB 17228-3: Filling the fluid mud from the Niskin Bottle into the plastic container.

Station list P448

Station GeoB No.	Date	Device	Time [UTC] seafloor / maximum wire length	Latitude [N]	Longitude [E]	Latitude [N] digital log	Longitude [E] digital log	Water depth [m]	Samples / Core recovery
17201-1	08.03.13	CTD	11:17	41°30'304	16°24'049	41.50506	16.40081	45	
17201-2	08.03.13	ISP	11:37	41°30'300	16°23'992	41.50500	16.39986	18,35	
17201-3	08.03.13	MUC	13:30	41°30'290	16°24'007	4150483	16.40012	46	40 cm
17201-4	08.03.13	MUC	13:59	41°30'269	16°24'007	41.50448	16.40012	48	40 cm
17201-5	08.03.13	SL	14:44	41°30'300	16°24'015	4150500	16.40025	57	361 cm
17202-1	08.03.13	CTD	17:56	41°39'980	16°14'983	41.66633	16.24971	14	
17202-2	08.03.13	ISP	17:10	41°39'959	16°15'013	41.66598	16.25021	13, 13	
17203-1	09.03.13	CTD	07:20	42°01303	15°10'306	42.02171	15.17177	29.4	
17203-2	09.03.13	ISP	07:35	42°01'290	15°10'310	42.02150	15.17183	7, 20	
17203-3	09.03.13	MUC	09:15	42°01'290	15°10'298	42.02150	15.17163	37	37 cm
17203-4	09.03.13	MUC	09:40	42°01'287	15°10'294	42.02156	15.17156	33	33 cm
17204-1	09.03.13	CTD	13:58	42°19'005	15°14'977	42.31675	15.24995	125	
17204-2	09.03.13	CTD	14:20	42°18'987	15°14'989	42.31645	15.24981	125	
17204-3	09.03.13	MN	14:48	42°18'999	15°15'015	42.31665	15.25025	120	
17205-1	09.03.13	CTD	17:59	42°14'988	14°48'325	42.24980	14.80541	60	
17206-1	10.03.203	CTD	05:17	43°21'009	14°05'977	43.35015	14.09961	61	
17206-2	10.03.203	ISP	05:34	43°21'011	14°05'955	43.35018	14.09925	21, 40	
17206-3	10.03.203	MUC	07:25	43°21'015	14°05'975	43.35006	14.09925	66	43 cm
17206-4	10.03.203	MUC	07:52	43°21'004	14°05'966	43.35007	14.09943	66	42 cm
17206-5	10.03.203	MUC	08:14	43°20'092	14°05'985	43.33487	14.09975	65	42 cm
17207-1	10.03.203	CTD	11:25	43°22'001	13°48'023	43.36668	13.80038	10.5	
17207-2	10.03.203	ISP	12:36	43°21'973	13°48'003	43.36621	13.80005	6	
17207-3	10.03.203	ISP	12:36	43°21'973	13°48'003	43.36621	13.80005	6	
17207-4	10.03.203	MUC	14:50	43°21'994	13°48'014	43.36656	13.80023	12	13 cm
17207-5	10.03.203	MUC	15:04	43°21'997	13°47'990	43.36662	13.79983	12	13 cm
17207-6	10.03.13	MUC	15:19	43°21'997	13°47'997	43.36662	13.79995	12	13 cm
17208-1	10.03.203	CTD	16:49	43°19'019	13°53'965	43.31698	13.89941	15	
17209-1	10.03.203	CTD	19:41	43°22'286	14°21'956	43.37143	14.36593	85	
17209-2	10.03.203	MN	20:00	43°22'290	14°21'950	43.37150	14.36583	85	
17210-1	11.03.13	CTD	05:15	43°54'971	13°17'997	43.91618	13.29995	40	
17210-2	11.03.13	ISP	06:30	43°54'991	13°18'019	43.91651	13.30032	24, 28	
17210-3	11.03.13	MUC	07:09	43°54'007	13°18'013	43.90011	13.29082	49	30 cm
17210-4	11.03.13	MUC	07:33	43°54'007	13°18'036	43.90011	13.30060	49	38 cm
17211-1	11.03.13	CTD	09:25	43°49'266	13°12'070	43.82110	13.20117	00:00	
17211-2	11.03.13	ISP	10:35	43°49'261	13°12.036	43.82101	13.20060	5	
17211-3	11.03.13	ISP	10:35	43°49'261	13°12.036	43.82101	13.20060	5	
17211-4	11.03.13	MUC	12:30	43°49'288	13°12'037	43.82146	13.20062	14	
17211-5	11.03.13	MUC	12:39	43°49'307	13°12'010	43.82178	13.20017	14	no recovery
17211-6	11.03.13	MUC	12:56	43°49'297	13°12'002	43.82161	13.200003	14	22 cm
17211-7	11.03.13	MUC						14	22 cm
17212-1	11.03.13	CTD	14:02	43°50'065	13°10'593	43.83442	13.17655	12	
17212-2	11.03.13	ISP	15:15	43°50'062	13°10'591	43.83437	13.17652	5	
17213-1	11.03.13	CTD	16:29	43°50'306	13°13'955	43.83843	13.23325	15	
17214-1	11.03.13	CTD	19:35	43°46'004	13°47'966	43.76673	13.79943	68.1	
17215-1	12.03.13	CTD	06:02	44°51'331	12°34'014	44.85551	12.56690	19	
17215-2	12.03.13	ISP	07:15	44°51'316	12°33'986	44.85527	12.56643	5, 13	
17215-3	12.03.13	MUC	07:54	44°51'273	12°34'051	44.85455	12.56752	22	33 cm
17215-4	12.03.13	MUC	08:13	44°51.273	12°34'033	44.85455	12.56722	22	33 cm
17215-5	12.03.13	MUC	08:25	44°51'273	12°34'031	44.85455	12.56718	22	no recovery
17215-6	12.03.13	MUC	08:39	44°52'268	12°34'025	44.87113	12.56708	22	no recovery
17216-1	12.03.13	CTD	09:43	44°46'970	12°36'317	44.78283	12.60528	24.2	
17216-2	12.03.13	ISP	10:52	44°46'961	12°36'306	44.78268	12.60510	6, 8	
17216-3	12.03.13	MUC	11:28	44°46'967	12°36'300	44.78278	12.60500	27	43 cm
17216-4	12.03.13	MUC	11:46	44°46'969	12°36'300	44.78281	12.60500	27	43 cm
17217-1	12.03.13	CTD	13:29	44°45'062	12°45'000	44.75103	12.72580	31	
17217-2	12.03.13	MUC	13:29	44°45'049	12°44'993	44.75081	12.74988	33	
17218-1	12.03.13	CTD	15:29	44°43'988	12°53'499	44.73313	12.89165	36	
17218-2	12.03.13	ISP	16:30	44°43'996	12°53'483	44.73327	12.89138	7, 13	

17219-1	13.03.13	CTD						41.4	
17219-2	13.03.13	MN	13:35	42°44'995	14°47'962	42.74992	14.79936	197.5	
17219-3	13.03.13	MN	14:00	42°45'009	14°47'967	42.75015	14.79945	197.5	
17220-1	13.03.13	CTD	18:42	42°35'983	14°15'362	42.59971	14.25603	41.4	
17220-2	13.03.13	ISP	19:41	42°36'004	14°15'306	42.60007	14.25510	18,23	
17221-1	13.03.13	CTD	22:59	42°27'121	14°22'990	42.45202	14.38316	27	
17221-2	13.03.13	ISP	02:11	42°27'124	14°23'024	42.45207	14.38373	13	
17222-3	13.03.13	ISP	03:30	42°27'124	14°23'024	42.45207	14.38373	13	
17222-1	14.03.13	CTD	03:30	42°27'265	14°28'014	42.45441	14.46690	67.4	
17222-2	14.03.13	ISP	04:15	42°27'261	14°26'000	42.45435	14.43333	10,15	
17222-3	14.03.13	MUC	04:59	42°27'992	14°27'992	42.46653	14.46653	73	36 cm
17222-4	14.03.13	MUC	05:12	42°27'895	14°27'985	42.46491	14.46641	73	36 cm
17223-1	14.03.13	MUC	07:04	42°27'139	14°23'039	42.45231	14.45231	27	35 cm
17223-2	14.03.13	MUC	07:24	42°27'155	14°23'036	42.45258	14.38393	27	35 cm
17224-1	14.03.13	SL	11:10	42°14'147	14°54'247	42.23578	14.90456	76	380 cm
17225-1	14.03.13	CTD	12:47	42°09'981	14°53'996	42.16635	14.88745	43.1	
17226-1	17.03.13	SL	08:04	35°16'436	21°41'498	35.27393	21.69163	3840	81 cm
17226-2	17.03.13	MUC	10:24	35°16'430	21°41'523	35.27383	21.69205	3845	no recovery
17226-3	17.03.13	SL	12:30	35°16'399	21°41'498	35.27331	21.69163	3840	87 cm
17227-1	17.03.13	SL	15:11	35°16'490	21°37'961	35.27483	21.63268	3548	gone
17227-2	17.03.13	MN							
17227-3	17.03.13	CTD	18:23	35°16'499	21°37'971	35.27415	21.63285	3276	
17228-1	17.03.13	NB	22:10	35°13'871	21°28'305	35.23118	21.47175	3660	de water at 3658
17228-2	18.03.13	NB	01:30	35°13'871	21°28'305	35.23118	21.47175	3720	anic mud at 3718
17228-3	18.03.13	NB	04:00	35°13'871	21°28'305	35.23118	21.47175	3720	anic clay at 3718
17229-1	18.03.13	CTD	07:57	35°17'001	21°37'960	35.28335	21.63267	3281	no recovery
17229-2	18.03.13	MUC	09:05	35°17'010	21°37'980	35.28350	21.63267	3544	34 cm
17230-1	18.03.13	CTD	11:02	35°16'457	21°41'464	35.27428	21.69107	200	
17230-2	18.03.13	MUC	12:29	35°16'935	21°41'516	35.28225	21.69193	3847	52 cm
17231-1	18.03.13	MN	15:27	35°20'013	21°36'929	35.33355	21.61548	3321	
17232-1	19.03.13	MN	08:40	37°31'140	19°44'360	37.51900	19.73933	3336	
17232-2	19.03.13	CTD	09:43	37°31'140	19°44'360	37.51900	19.73933	200	
17233-1	19.03.13	CTD	15:09	38°09'568	19°11'260	38.15946	19.18767	200	
17233-2	19.03.13	MN	15:30	38°09'560	19°11'270	38.15933	19.18783	3159	
17234-1	20.03.13	MN	08:45	40°00'00	17°35'010	40.00000	17.58350	911	
17234-2	20.03.13	CTD	08:46	40°00'002	17°35'011	40.00003	17.58351	200	
17235-1	20.03.13	MUC	10:18	40°08'005	17°40'970	40.13341	17.68283	188	51 cm
17235-2	20.03.13	MUC	11:12	40°08'000	17°41'011	40.13333	17.68351	188	51 cm
17236-1	20.03.13	MUC	13:06	40°12'523	17°31'482	40.20872	17.470	207	33 cm
17236-2	20.03.13	MUC	13:29	40°12'499	17°31'495	40.20831	17.52491	207	33 cm
17237-1	20.03.13	MUC	15:18	40°15'516	17°21'477	40.25860	17.35795	401	
17237-2	20.03.13	MUC	15:54	40°15'509	17°21'492	40.25848	17.35820	401	no recovery
17237-3	20.03.13	MUC	16:11	40°15'521	17°21'478	40.25868	17.35977	401	no recovery
17238-1	20.03.13	CTD	17:06	40°16'013	17°21'476	40.26688	17.35793	323.8	
17238-2	20.03.13	ISP	17:45	40°16'017	17°21'488	40.26695	17.35813	17,22,30	
17239-1	20.03.13	CTD	20:18	40°12'495	17°31'498	40.20793	17.52497	194.3	
17239-2	20.03.13	ISP	20:40	40°12'498	17°31'498	40.20793	17.52497	20,40, 50	
17240-1	20.03.13	CTD	23:34	40°08'001	17°41'036	40.13335	17.68393	178	
17240-2	21.03.13	ISP	23:47	40°08'007	17°40'791	40.13345	17.67985	25, 30	
17241-1	21.03.13	CTD	02:40	40°00'004	17°49'976	40.00007	17.83293	214.9	
17241-2	21.03.13	ISP	03:00	40°00'018	17°47'973	40.00030	17.79955	30, 40	
17242-1	21.03.13	CTD	06:05	39°50'018	17°58'968	39.83363	17.98280	108.6	
17242-2	21.03.13	ISP	06:15	39°50'041	17°58'007	39.83401	17.96678	30, 35	
17243-1	21.03.13	CTD	08:34	39°45'458	17°53'721	39.75763	17.89535	161.4	
17243-2	21.03.13	ISP	08:51	39°45'594	17°53'753	39.75990	17.89588	20, 150	
17244-1	21.03.13	MN	11:30	39°38'030	17°47'450	39.63383	17.79083	1235	
17245-1	21.03.13	MN	15:35	39°12'020	17°33'86	39.20033	17.56433	1025	

Abbreviations used:

MUC

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